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Errata on p 320

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A
Mechanical Account
OF
POISONS,
In Several
ESSAYS.

BY

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Coll. Med. Lond. & R. S. S.
Phyſician to his MAJESTY.

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ADVERTISEMENT.

THIS Book was firſt publiſhed in the year 1702. and reprinted with very few additions, in 1708. I then really intended never more to trouble my ſelf about it: but the demand for it having for many years been ſo great, as to tempt ſome Bookſellers to print it twice or thrice, very incorrectly, in a *piratical* way (as they call it) without my knowledge; I have thought it right, both in juſtice to the public and myſelf, to give a new edition of it.

IT will eaſily be believed, that after more than forty years (ſpent neither without ſtudy nor experience) I cannot be fond of a little performance in phyſic, written at a time of life, in which the facts muſt, for the moſt part, be taken from other authors, and the reaſonings upon them would often require more patient thinking, and a riper judgment. And therefore I make no doubt but the public always made great allowances upon this account, when they gave the book ſo favourable a reception.

In return to this kind uſage, I have now taken ſome pains to reconſider my ſubject. Beſides many other improvements, I have often from my theory drawn obſervations uſeful, as I imagine, in practice. Neither have I been aſhamed, on ſome occaſions, (as the *Latins* ſaid) *caedere vineta mea*, to retrench or alter whatever I have judged to be wrong. *Dies diem docet.* I think truth never comes ſo well recommended, as from one who owns his error: and it is allowed that our firſt maſter, *Hippocrates*, never ſhewed more wiſdom and greatneſs of mind, than in confeſſing his miſtake, in taking a *Fracture* of the ſkull for the natural *Suture (a)*; and the compliment, which *Celſus* (*b*) makes to him on this occaſion, is very remarkable and juſt: *More ſcilicet*, inquit, *magnorum virorum, et fiduciam magnarum rerum habentium. Nam levia ingenia, quia nihil habent, nihil ſibi detrahunt: magno ingenio, multaque nihilominus habituro, convenit etiam ſimplex veri erroris confeſſio; praecipueque in eo miniſterio, quod utilitatis cauſa poſteris traditur.*

(*a*) Epidem. lib. v. § 14.
(*b*) Medicin. lib. viii. c. 4.

I MIGHT however urge in my excuſe, that as the notions I have retracted, regard chiefly the nervous fluid and its properties; ſo my new reaſonings are founded upon experiments of electricity and attraction, applied to this fluid, which at the time of my writing were not known. The inſtructive *Queries* and *Suppoſitions* of Sir *Iſaac Newton*, and the ſurpriſing electrical operations of Mr. *Stephen Gray* (*c*), improved by Monſieur *Du Fay*, at *Paris* (*d*), had not then inlightened the learned world.

BUT there are here two additions, which I ought particularly to mention: the firſt is the *Introduction*. Having obſerved, that the action of poiſons, though they are of very different kinds, is generally

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(*c*) Vid. Phil. Tranſ.

(*d*) Vid. Memoires de l'Academie, 1733, 1734, 1737.

uniform; and alſo, that the animal ſpirits are firſt affected by it; I have thought it proper, as this opinion may ſeem ſomewhat ſtrange and ſingular, to premiſe an inquiry into the nature of the nervous fluid, of which it muſt be owned that we know too little. And if, in a matter ſo abſtruſe and difficult, what I have advanced has more in it of conjecture than of demonſtration, it may be allowed to be ſomething

Quadam prodire tenus, ſi non datur ultra (*e*).

Whoever will paſs a judgment upon ſuch nice ſpeculations, muſt take the whole ſcheme together. Truth is always a connected ſcheme; and inferences juſtly drawn not only illuſtrate, but confirm one another.

THE other addition is, "An "anatomical deſcription of thoſe

(*e*) Horat. Epiſt. i. v. 32.

“ parts in a Viper and in a Rattle-“ Snake, which are concerned in “ their poiſon,” by our great anatomiſt the learned and ingenious Dr. *Nicholls*. He having taken notice, that the *Anatomical Obſervations on the Viper*, by Dr. *Areſkine*, in the firſt edition, were neither complete, nor in every point true, has been pleaſed to give a new anatomy of the whole head, not only of the common Viper, but alſo of that larger kind of it, the Rattle-Snake: that ſo thoſe parts, which cannot ſo eaſily be ſeen in the ſmaller, may more diſtinctly appear in the bigger animal. How accurately he has performed this taſk, and how thoroughly he has explained the mechaniſm and offices of the ſeveral organs, any one may judge, who will compare his deſcriptions with the beſt of thoſe, which have been hitherto made by other anatomiſts.

THE PREFACE TO THE FIRST EDITION.

To give an exact and particular account of the nature and manner of the action of Poiſons, *is no eaſy matter; but to diſcourſe more intelligibly of them, than authors have hitherto done, not very difficult. One may without much pains ſhew their effects to be owing to ſomething more than the bare qualities of heat or cold; and diſcover the footſteps of mechaniſm in thoſe ſurpriſing* phaenomena, *which are commonly aſcribed to ſome occult or unknown principle. But to unravel the ſprings of the ſeveral motions, upon which ſuch appearances depend, and trace up all the ſymptoms* *to their firſt cauſes, requires ſome art as well as labour: and that both upon the account of the exquiſite fineneſs, and marvellous compoſition, of the animal machine in which they are tranſacted, and of the minuteneſs of thoſe bodies, which have the force to induce in it ſuch ſudden and violent alterations.*

I HAVE *attempted ſomewhat this way in the following* Eſſays; *in which I do not promiſe methodical and finiſhed treatiſes, but only ſome ſhort hints of natural hiſtory, and rude ſtrokes of reaſoning: which, if put together and rightly improved, may perhaps ſerve to furniſh out a more tolerable Specimen of the* Doctrine *of* Poiſons, *than has yet been publiſhed.*

THE *firſt draught of this ſmall piece I made ſome years ſince, entertaining*

tertaining myſelf at leiſure hours with experiments on Vipers, and other venomous creatures; examining now and then the texture of Arſenic, Mercury Sublimate, and the like malignant ſubſtances; turning over what authors had ſaid on the ſeveral ſubjects, and making ſuch remarks as from time to time occurred.

THESE *continued inquiries made up at laſt three or four ſhort diſcourſes; which when I began to digeſt into order, the increaſe of buſineſs contracted the intervals of my ſpare time: and the diverſion of ſuch ſtudies quickly giving way to the ſeverity of more neceſſary labours, they were quite thrown by. Till talking not long ſince with Dr.* Areſkine *concerning the Viper, I took occaſion to review my ſcattered papers, and confirm my reaſonings by new experiments. He very rea-*

dily offered me his Anatomical Obſervations. *Theſe I have put at the end of the firſt* Eſſay: *which do not promiſe a complete diſſection of the animal, but chiefly ſhew the make of thoſe parts, which are concerned in the poiſon.*

My *deſign, in thinking of theſe matters, was, to try how far I could carry mechanical conſiderations in accounting for thoſe ſurpriſing changes, which Poiſons make in an animal body; concluding (as I think, fairly) that if ſo abſtruſe* phaenomena *as theſe come under the known laws of motion, it might very well be taken for granted, that the more obvious appearances in the ſame fabric are owing to ſuch cauſes, as are within the reach of geometrical reaſoning: and that therefore as the firſt ſtep towards the removal of a diſeaſe is to know its origin; ſo he is likely*

likely to be the beſt phyſician, who, having the ſame aſſiſtance of obſervations and hiſtories with others, beſt underſtands the human oeconomy, *the texture of the parts, motions of the fluids, and the power which other bodies have to make alterations in any of theſe.*

Nor *indeed ought any one to doubt of this, who conſiders that the animal* compages *is not an irregular maſs, and diſorderly jumble of atoms, but the contrivance of infinite wiſdom, and the maſter-piece of that creating power, who has been pleaſed to do all things by eſtabliſhed laws and rules, and that harmony and proportion ſhould be the beauty of all his works.*

It *were therefore heartily to be wiſh'd, that thoſe gentlemen, who are ſo much afraid of introducing mathe-*

matical ſtudies, that is, demonſtration and truth, into the practice of Phyſic, were ſo far at leaſt inſtructed in the neceſſary diſciplines, as to be able to paſs a true judgment, what progreſs and advances may be made this way. They would not then perhaps decry an attempt of ſo much moment to the welfare of mankind, as vain and impoſſible; becauſe it is difficult, and requires application and pains.

IT *is very evident, that all other methods of improving Medecine have been found ineffectual, by the ſtand it was at for above two thouſand years: and that ſince of late Mathematicians have ſet themſelves to the ſtudy of it, men already begin to talk ſo intelligibly and comprehenſibly, even about abſtruſe matters, that it may be hoped in a ſhort time, if thoſe, who are deſigned for this profeſſion, are*

are early, while their minds and bodies are patient of labour and toil, initiated in the knowledge of numbers and geometry, that mathematical learning will be the diſtinguiſhing mark of a phyſician from a quack; and that he, who wants this neceſſary qualification, will be as ridiculous as one without Greek or Latin.

I HAVE, *as to what regards the animal oeconomy, referred as much as I could to the works of* Bellini, *which have brought great light into the dark regions of Phyſic, and taught us to argue clearly and conſiſtently, inſtead of amuſing our ſelves with unintelligible words or precarious hypotheſes. The Diſſertations of Dr.* Pitcairne, *the honour of his profeſſion in* Scotland, *are a convincing proof of the advantage of ſuch a mechanical way of reaſoning: nor could malice it ſelf deny this, were* *not ignorance in confederacy with it, which will ſecure any one from being benefited by the moſt uſeful demonſtrations.*

NOTWITHSTANDING *this I have been forced now and then to make digreſſions from my ſubject, to clear ſome doctrines neceſſary to be known, which have not been explained by others. For indeed the* data, *from which we argue in theſe matters, are by many too few.* Dr. Cheyne, *the Author of the* New Theory of Fevers, *has enumerated ſeveral particulars, in which the theoric part of Medicine ſtill wants improvement. If theſe deficiencies were made good, we might with more eaſe proceed in our inquiries into human nature; and ſhould ſoon convince the world, that the moſt uſeful of arts, if duly cultivated, is more than mere conjecture, or baſe empiriciſm.*

As *to the authors I have made uſe of, who have treated of Poiſons, I have quoted only thoſe, who furniſhed me with matter of fact: for there are but few originals; and very large volumes on this ſubject many times contain little more than a collection of vulgar errors.*

I had *once thought to have carried theſe ſearches farther; in particular, beſides what is occaſionally mentioned in the laſt* Eſſay *concerning infection in acute diſeaſes, to have inquired into the nature of contagious and hereditary diſtempers. But the humour of ſcribling would not hold out; and ſome perhaps will ſay, 'tis well enough it did not: for I am not ignorant, how few I am like to pleaſe. If it be hard to think and write juſtly, 'tis harder yet to bring others to one's own* taſte; *nor ſhall I be at all angry, if to many I have*

I have afforded matter of ſatyr and invective: leſs wit ſuffices for theſe, than for the diſcovery of uſeful truths. They, who have no ſmattering of mathematical knowledge, are incompetent judges of what ſervice I have done towards the improvement of the theory, or practice of medicine: and thoſe, who are acquainted with theſe matters, will, it may be, think it ſomething to talk intelligibly on ſuch difficult and abſtruſe points. I neither want applauſe, nor fear cenſure: and therefore be the fate of theſe papers what it will, as they were firſt penned for my own ſatisfaction, and innocent entertainment; ſo I am reſolved they ſhall never engage me in the trouble of quarrels or diſputes.

London, 1702.

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INTRODUCTION.

THOSE things, which are experienced to be in their whole nature, or in their moſt remarkable properties, ſo contrary to the animal life, as in a ſmall quantity to prove deſtructive to it, are called Poiſons: whether they are hurtful by being taken inwardly at the mouth, or communicated to the body externally by a wound.

THIS ſubject has afforded matter for great diſputes among philoſophers, in their inquiries into the frame of the world. Some have made it an objection to the goodneſs of the Creator, that there ſhould be any ſuch productions as Poiſons in nature: on the other hand, *Paracelſus*, *Van Helmont*, and their followers, fond of magnifying their chemical art, tell us, that poiſons are really deſigned for other purpoſes than is commonly thought; they being indeed great medicines, when their concealed uſeful qualities are, by our ſtudy and labour, diſcovered and brought out of them (*a*). To prove this, they alledge that remarkable ſaying of the wiſe man (*b*): "God made not death, "neither hath he pleaſure in the "deſtruction of the living. For he "created all things, that they might "have their being; and the gene"rations of the world were health"ful: and there is no poiſon of de-

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(*a*) Vid. J. B. Van Helmont opera, pag. 373.
(*b*) Wiſdom of Solomon, chap. i. ℣ 13.

" ſtruction in them, nor the king-
" dom of death upon the earth."

As the knowledge of thoſe minute philoſophers, who find faults in the diſpoſition of the univerſe, is generally too ſuperficial; ſo I doubt the reaſoning againſt them of our adepts, whoſe ſight is often dazzled by the light of their furnaces, will, in the preſent affair, appear too deep, and far-fetched. For it does not look like univerſal beneficence, to create ſubſtances, whoſe manifeſt and obvious qualities are noxious and deſtructive, though they may have other virtues which are ſalutary, but which are only to be extricated from them by deep ſearches of art, and the torture of the fire.

The true ſtate of the caſe ſeems to be this. The productions of nature of this kind, as to us, are often medicinal, either in the external or internal uſe of them; and experience, improved by reaſoning, teaches us to prepare and apply them to various purpoſes: but they are alſo not only phyſic, but even food to ſome other animals, which, by natural inſtinct, devour them; and theſe themſelves afford not only good nouriſhment, but ſometimes remedies to us. Little inſects, which we think troubleſome, are neceſſary to the life of wholeſome birds and other creatures. Goats and quails are fattened by hellebore (*c*), ſtarlings by hemlock (*d*), and hogs innocently eat henbane (*e*); all which we call poiſonous. Many

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(*c*) Lucret. lib. iv. 645.
(*d*) Galen. Simpl. Medic. Fac. l. iii. c. 18.
(*e*) Sext. Empiric. Hypoth. Emp. i.

inſtances might be given of the like kind. Will any one ſay that the venom of the *Viper* is not made for our good, when without it (as will be obſerved in the following diſcourſe) this reptile could not have been provided with thoſe noble qualities, which render it effectual againſt ſome very ſtubborn diſeaſes?

BUT this queſtion may perhaps ſeem more difficult with regard to poiſonous minerals: as, for inſtance, arſenic, which we find to be diffuſed almoſt through the whole mineral kingdom. Now it muſt be obſerved, that this is not a perfect mineral, but an active ſubſtance made uſe of by nature in preparing ſeveral metals in the earth, which are of great ſervice to mankind. It particularly appears to be ſo in the growth of ſilver, copper, tin and lead; the ores of all which contain, beſides common ſulphur, a great deal of arſenic: ſo that this, in the language of the chemiſts, may be called a mineraliſing principle. And the caſe will be found to be much the ſame in all natural productions of this kind.

In ſhort, there is in the fabric of the world a great chain and dependency of things upon one another: and though our knowledge does not reach to every particular link of it, yet the farther we advance in the ſtudy of nature, the more we ſhall find that

Whatever is, is right (f).

But how much more would it appear to be ſo, could we look into the whole ſyſtem of the univerſe, and ſee the relation which our world perhaps bears to ſome of thoſe innumerable others in the Immenſe Space, which the Almighty Being may probably have made dependent upon one another by eſtabliſhed laws and order!

(f) Pope's Eſſay on Man, Epiſt. i.

As to the text cited out of *Solomon*, the meaning of it is plainly this. "God created nothing "to be deſtructive to mankind, "but gave to all things their "proper nature; and the productions of the world are wholeſome. Even poiſons were not "deſigned to be hurtful, but for "good uſes: for in all the earth "there are proviſions made againſt "death."

Before we proceed to particulars, it may not be improper to give a general idea of Poiſons, to explain in what manner they act, and by what alterations made in our bodies they become ſo hurtful.

Now as to this, it will appear from the following diſcourſes, that though Poiſons are of different kinds, as well thoſe which kill by wounds, as thoſe which are taken inwardly; yet there is a great agreement in the manner of producing their effects: and that even internal poiſons exert their force in a manner analogous to the external.

Venomous animals, when they bite or ſting, inflict a wound, and inſtil into it a drop or more of liquor, which infects the fluid of the nerves, and by this means inflames the membranes: hereupon a ſwelling ariſes, ſometimes to a degree of mortification, which ſpreads to the neighbouring parts.

Poisonous ſubſtances, being ſwallowed, wound the nervous coat of the ſtomach. An inflammation enſues, which, according as the poiſon is of a greater or leſſer power, is communicated to the contiguous coats; and in ſome caſes, eſpecially if it be of a mineral nature, ends in a perfect gangrene. For the difference between mineral and vegetable poiſons lies chiefly in this, that the former are of greater force than the latter.

But in all accidents of this kind, whether the wound be outward or inward, the miſchief does not ſtop at the part affected, but is carried farther, even through the whole body.

This is done by the great activity of the nervous fluid, one part of which being infected immediately taints all the reſt: and thus the whole ſyſtem of nervous expanſions is drawn into ſpaſms and convulſions; which, according to the different offices of the parts to which the nerves belong, produce different ſymptoms. In the ſtomach and inteſtines, theſe ſpaſms cauſe ſickneſs, vomitings and gripes; in the brain, *deliria*, ſleepineſs and epileptic fits; in the heart, intermiſſions of the arterial pulſe, palpitations and ſwoonings; in the lungs, difficulty of breathing, with ſtrangling and ſuffocations; in the liver, by the ſpaſmodic contraction of the biliary ducts, the bile is returned into the blood, and makes a jaundice; in the kidneys, the ſame diſpoſition of the urinary canals interrupts the ſecretion of urine, and makes it quite irregular. In ſhort, the animal oeconomy is all diſturbed: and though different poiſons may ſhew their moſt remarkable effects in different parts, and theſe, according to the violence of the hurt, may appear in very different degrees; yet the ſymptoms always make it plain, that the firſt bad impreſſion is made upon the animal ſpirits.

I HAVE in another place ſhewn, from the manner in which perſons are ſeized in peſtilential fevers, that is, with faintneſs, giddineſs, palpitations of the heart, tremblings, *etc.* that the nervous fluid is likewiſe principally affected in theſe diſeaſes; contagion being indeed a real poiſon (*g*).

It will therefore be proper to inquire into the nature of this liquor: for I think no regard ought to be had to the immechanical notions of thoſe authors, who imagine that there is no ſuch thing in an animal body; and that muſcular motion and ſenſation are performed only by the vibrations of the fibres of the nerves, without the intervention of any ſpirituous fluid.

(*g*) Vid. Diſcourſe on the Plague.

They, who can ſatisfy themſelves with ſuch a ſcheme, ſeem to have very little attended to what is tranſacted within us, in the effects of ſudden paſſions of the mind; in the inſtantaneous tranſlations of diſeaſes from one part to another, as particularly in the gouty humour; and in the ſurpriſing changes, made ſometimes in a moment, in the ſecretions of thoſe liquors, upon which life depends.

But, to ſay no more, as the brain is manifeſtly a large gland, with a moſt exquiſite *apparatus* for the ſeparation of a liquor from the blood; this muſt, like all other glands, have an excretory duct: now the nerves are evidently contrived for this purpoſe, and conſequently muſt always contain a proper ſubtile juice.

To proceed therefore; this fluid, ſo far as we can diſcover by its effects, is a thin volatil liquor, of great force and elaſticity; being indeed moſt probably a quantity of the *univerſal elaſtic Matter*, incorporated with fine parts of the blood, ſeparated in the brain, and lodged in the fibres of the nerves. This is the inſtrument of muſcular motion and ſenſation, a great agent in ſecretions, and indeed in the whole buſineſs of the animal oeconomy.

By the univerſal elaſtic matter I underſtand that ſubtile and active ſubſtance, diffuſed throughout the univerſe, which our great philoſopher,

pher, Sir *Iſaac Newton*, ſuppoſes to be the cauſe of the refraction and reflexion of the rays of light, and by the vibrations of which light communicates heat to bodies; and which readily pervading all bodies, produces many of their actions upon one another.

I REFER, for the ſentiments of this divine man, to his Opticks (*h*); but more eſpecially to a moſt remarkable letter of his to the honourable Mr. *Boyle*, written many years ſince (*i*). Whoever thoroughly comprehends and conſiders what is delivered in theſe Pieces, under the form of *Queries* and *Suppoſitions*, will be let into ſome know-

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(*h*) Qu. 23, 24.

(*i*) Publiſhed in the life of Mr. Boyle, prefixed to his works, pag. 70. which life is ſince printed by itſelf.

ledge of the ſecret ſprings of nature; and will then, I hope, be inclined to think, that I have not been wrong in endeavouring to introduce the ſame principles from the inanimate into the animated world.

It ſeems very reaſonable, from that uniformity, which there is in the laws of nature, to conclude that the animal ſpirits are ſomething of this kind: for there can be no greater preſumption in favour of a ſcheme, than that it is ſimple, and of a piece with the known ſyſtem of the univerſe.

Now, an active ſubſtance of this kind in the nerves muſt neceſſarily be very ſuſceptible of alterations from other bodies of extreme minuteneſs and great force:

in like manner, as we ſee ſome chemical liquors, upon their firſt approach to each other, to fall into fermentations ; the reſult of which is a compound mixture of a quite different nature, from what might have been expected from the ſingle ingredients.

THUS the compound ſpirit of nitre put to oil of cloves will efferveſce even to a flame : a fermentation being indeed no more than the attraction and repulſion of the particles of different bodies, when they come together.

BY reflecting upon the *phaenomena*, which the experiments of late years made upon electricity (*k*)

(*k*) Philoſ. Tranſact. N° 366. 417. 422. 423. 426. 436. 439. 444.

have diſcovered to the world, and viewing the attractions and repulſions of the fineſt particles of electrical ſubſtances, any one may eaſily form an idea of this animal fluid, and of the exceſſive force and velocity with which it acts.

It is very obſervable, that the communication of electricity is much greater thro' animal than thro' inanimate bodies: that is, the elaſtic fluid paſſing thro' theſe meets with a greater quantity of the ſame matter in them than in the other; the ſolid animal fibres being more adapted to receive it. The experiment of the boy ſuſpended on ſilk or hair Lines (*l*) is equally ſurpriſing and inſtructive, demonſtrating this elaſtic ſpirit, even to

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(*l*) Philoſoph. Tranſact. N°. 417.

our ſight and touch. And if the nerves, as Sir *Iſaac Newton* ſuppoſes, are very ſmall, but ſolid, pellucid and uniform *capillamenta*, wrapt up in bundles; the glaſs tube rubbed by the hand, and its action with the elaſtic fluid, repreſent to us in ſome degree the nerves and the animal ſpirits lodged in them.

Perhaps the proſecution of ſuch trials upon living creatures may in time make us more acquainted with the laws and actions of this Impetuous Part, (as *Hippocrates* (*m*) calls it) in the animal machine.

Ita res accendunt lumina rebus (*n*).

(*m*) Epidem. lib. vi. § 8. Τὰ ὁρμῶντα σώματα.

(*n*) Lucret. lib. i. ℣ 1110.

It is ſufficient to our preſent purpoſe, to have deſcribed the nervous fluid ſo far, as to ſhew it to be ſuch a one as is indowed with great activity and force, and therefore capable of receiving various alterations from other bodies, eſpecially ſuch as conſiſt likewiſe of very ſubtile and powerful particles: and all poiſons, we know, are of this kind.

I was of opinion, when I firſt wrote theſe *Eſſays*, that the effects of poiſons, eſpecially thoſe from venomous animals, might be accounted for by their affecting the blood only: but the conſideration of the ſuddenneſs of their miſchief, too quick to be brought about in the courſe of the circulation, (for the bite of a Rattle-ſnake killed a dog in leſs than a quarter of a minute (*o*), together with the nature of the ſymptoms entirely nervous, induced me to change my ſentiments. For if, as Dr. *Keil* has computed (*p*), the velocity of the blood is more than five thouſand times leſſer at the fortieth branch from the great artery, than it is in this artery before any ramification is made from it; how is it poſſible that the brain, heart, *etc.* ſhould feel ſo ſudden a hurt, unleſs it were conveyed to them by a *medium* of much greater quickneſs? and this can be no other than the animal ſpirits.

NEITHER is it amiſs to add, that the obſervations I have

(*o*) Philoſoph. Tranſact. N°. 399.
(*p*) Vid. Tent. Medico-Phyſic. 2.

made, if improved, may alſo afford hints uſeful in the cure of many diſeaſes. For, though ſome of thoſe diſtempers, which we call nervous, as particularly paralytic weakneſſes, may be accounted for by irregular motions and obſtructions of the animal ſpirits only; yet many of them certainly muſt ariſe from ill affections of the ſpirituous fluid itſelf. It can, for inſtance, never be conceived that the ſurpriſing appearances in phrenitical, maniacal, and melancholy diſorders, ſhould be brought about without alterations, ſuitable to the different caſes, made in that active liquor, by which the mind governs the body.

There are many other caſes, judged extraordinary, and not eaſily to be explained, which depend almoſt ſolely on the animal ſpirits. I ſhall mention only one.

A SURGEON of great merit and experience, in a very uſeful book, lately publiſhed (*q*), has obſerved, that ſometimes in gun-ſhot wounds, attended with a great laceration of the membranes, though things ſeem to go on well for ſome days; yet the patient is ſuddenly ſeized with convulſions in his face, which ſo fix the jaws that he cannot ſpeak, though the ſenſes are not impaired, and inevitably dies. It is, I think, very plain, that this dreadful ſymptom muſt be owing to the bad condition of the nervous liquor, which it is brought into by the tearing of the mem-

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(*q*) Ranby, on gun-ſhot wounds, p. 72.

branes, and which, notwithſtanding the tolerable ſtate of the blood, does, by its own diſorder, produce fatal conſequences.

AND, as we ſee in the mentioned electrical experiments, how remarkably the ſubtile matter is altered in its motions and effects, even by the ſimple contact of other bodies; it muſt certainly be allowed, that when the ſame comes to be incorporated with the fineſt part of the blood, it will, according to the condition in which this is, make a fluid, elaſtic indeed, but at different times in a different degree, and therefore variouſly affected by external agents.

BUT to return to poiſons: as the different ſtate of the nervous fluid may in ſome meaſure alter their effects; ſo likewiſe theſe themſelves, though really of the ſame kind, may yet ſo differ in their force and degree of action, as to be hurtful in various and ſeemingly different ways.

Upon this conſideration, the ſurpriſing ſtories related by authors, of the different deaths inflicted by Serpents of different kinds, particularly in *Africa*, are not at all incredible. I very well remember, that the learned *Paul Herman*, many years ago profeſſor of botany in the univerſity of *Leyden*, who had lived a great while in *India*, affirmed, that there were alſo in ſeveral parts of that country venomous creatures, of the ſame kind with thoſe deſcribed by the *African* hiſtorians, which killed by very different effects of their poiſon: and that upon due inquiry into facts, he was convinced that the beautiful deſcriptions in *Lucan* (r) of the various ſpecies of *Vipers*, which *Cato* met with in the hot *Libyan* deſerts, were not poetical fictions, but taken from nature. He had in his *muſeum*, preſerved in ſpirit of wine, ſeveral of theſe very ſerpents; particularly, the *Aſpis*, called *Nintipolongha Zeylanica*, whoſe bite induced a deadly ſleep; the *Dipſas*, or *Situla Macaſſarica*, which killed with an unquenchable thirſt; and the *Haemorrhous Macaſſaricus*, the poiſon of which was immediately followed by haemorrhages from all the pores of the body.

(r) Lib. ix.

For we muſt obſerve likewiſe, that although the firſt impreſſion of the poiſon be made upon the nervous ſpirit, yet the whole maſs of blood very quickly partakes of the hurt: not, I ſuppoſe, from any mixture of the venom with it, but from ſuch a corruption of it, as an irregular circulation, interrupted ſecretions, and ſtagnations in the ſmalleſt veſſels, (the conſequences of a vitiated nervous fluid) may naturally produce. Nor will this ſeem ſtrange, ſince ſuch a compounded liquor, as the blood is, may certainly undergo any imaginable changes by alterations made in its motion only.

Thus much concerning the general action of poiſons: the effects of the particular kinds of them, deſcribed in the following Diſcourſes, will (at leaſt in my opinion) be ſo many proofs of the truth of the doctrine I have advanced.

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ESSAY I.

Of the VIPER.

THE Viper has always been ſo remarkable for its venom, that the moſt remote antiquity made it an emblem of what is hurtful and deſtructive. Nay, ſo terrible was the nature of theſe creatures, that they were very commonly thought to be ſent as executioners of divine vengeance upon mankind for enormous crimes, which had eſcaped the common courſe of juſtice. Thus *Herodotus* (*a*) and *Aelian* (*b*) do both take notice that

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(*a*) Lib. ii. cap. 74.
(*b*) De Animalib. lib. xvii. c. 5.

Adders were ſacred among thoſe maſters of learning and ſuperſtition the *Egyptians*: that they affirmed of one ſort of them particularly, that they were made to be miniſters of the will of the gods, by averting evil from good men, and puniſhing the bad. Therefore the goddeſs *Iſis* was repreſented with an *Aſp* upon her head (*c*), to denote both her wiſdom and power. And from her the *Greeks* and *Romans* honoured *Minerva* with the ſame ſymbol, as ſhe often appears dreſſed in antique ſtatues and gems. And *Pauſanias* (*d*) obſerves of the *Arabians*, that they forbore to offer any violence to the Vipers, which were found near the Balſam-tree,

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(*c*) Aſpide cincta comas——Valer. Flacc. Argonautic. lib. iv. ver. 418. Dextrâ laevâque ſulcis inſurgentium viperarum cohibita. Apuleius Metam. lib. ii. p. m. 240.

(*d*) Boetic. p. m. 303.

as reputing them holy. The footſteps of which ſuperſtition ſtill remain among theſe people to this very day: for *Veſlingius* (*e*) ſaw many of them take theſe creatures into their houſes, feed them, and worſhip them as the *Genii* of the place. The ſame odd fancy obtains in the *Eaſt-Indies*: for the king of *Calicut* cauſes cottages to be ſet up for ſerpents to keep them from the rain, and makes it death to any that ſhall hurt one of them; thinking them to be heavenly ſpirits, becauſe they can ſo ſuddenly kill men (*f*). A remarkable inſtance of ſuch an opinion as this we have in the hiſtory of St. *Paul* (*g*), whom the people of *Malta*, when they ſaw the Viper leap

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(*e*) Not. in Alpin. de plant. Aegypt. cap. 14.
(*f*) Purchas's Pilgrimage, book v. chap. 12.
(*g*) Act. Apoſt. chap. xxviii.

upon

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upon his hand, preſently concluded to be a murderer; and as readily made a god of him, when, inſtead of having his hand inflamed, or falling down dead, (one or other of which is uſually the effect of thoſe bites) he without any harm ſhook the beaſt into the fire: it being obvious enough to imagine, that he muſt ſtand in a near relation at leaſt to the gods themſelves, who could thus command the meſſengers of their vengeance, and counterwork the effects of ſuch powerful agents.

I have ſometimes thought that this might be the reaſon, why antiquity not only repreſented the firſt maſters of Phyſic, *Hermes*, *Aeſculapius*, *Hippocrates*, *etc.* in their ſtatues and medals, with a Viper added to their figure, but alſo worſhipped them under this form:

for diſeaſes in thoſe days, eſpecially the moſt violent, plagues, fevers, *etc.* were in like manner, as theſe creatures, reputed the commiſſioned meſſengers of divine anger and diſpleaſure (*h*). They therefore, who by their art could cure and ſtop the courſe of theſe, as they were ſuppoſed to do this by the particular leave and aſſiſtance of heaven, ſo had honours paid to them accordingly; and this repreſentation was in the nature of an hieroglyphic character: for, as the learned *Spanheim* obſerves (*i*), the Viper was a ſymbol or emblem of divine power.

(*h*) Cornel. Celſ. praefat. in medicin. Morbos *ait* ad iram deorum immortalium relatos eſſe, et ab iiſdem opem poſci ſolitam.

(*i*) Divinae potentiae ſymbolum. Vid. Ezec. Spanhem. De uſu Numiſmat. p. m. 125, 126, et 181, et ſeq.

BUT to ſay the truth, that, which the ancients made the ſymbol of health, does not ſeem to have been the *Viper*, but the innocent *Snake* or *Serpent* of that kind, of which *Lucan* ſpeaks (*k*):

> *Vos quoq; qui cunctis innoxia numina terris*
> *Serpitis, aurato nitidi fulgore dracones.*

And if ſo, the reaſon *Macrobius* gives for this cuſtom may be a very good one; which is from the property all ſerpents have of caſting their *exuviae*, or upper ſkin, every year, which makes them fit emblems or repreſentations of health: the recovery whereof from ſickneſs and diſeaſes may juſtly be looked upon as the begining of a freſh period of life, and (as the

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(*k*) Pharſal. lib. ix. ver. 729.

throwing off the *ſenectus* of theſe creatures ſeems to be) the renewing of age (*l*).

BE that as it will, certain it is, that ſuch fond and ſuperſtitious fancies concerning the Viper, together with the miſtaken opinion that few of its parts were exempt from poiſon, did not ſuffer the ancients to make any curious inquiries into its nature by anatomy and experiments. And this is the cauſe of the many errors, they have delivered down to us in theſe points; which by gradual advances have ſince been rectified, and the inward make, properties, and genera-

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(*l*) Ideo ſimulacris eorum [Aeſculapii et Salutis] junguntur figurae draconum, quia praeſtant ut humana corpora, velut infirmitatis pelle depoſitâ, ad priſtinum revireſcant vigorem: ut vireſcunt dracones per annos ſingulos, pelle ſenectutis exutâ. Saturnal. lib. i. c. 20.

tion of this animal, have been largely treated of, more eſpecially M. *Redi* (*m*), *Charas* (*n*), and Dr. *Tyſon* in his Diſſection of the *Rattle-Snake* (*o*), which is a larger ſpecies of the Viper, have taken pains on this ſubject, to whoſe diſcoveries what is yet wanting, we ſhall add at the end of this Eſſay.

THE ſymptoms, which follow upon the bite of a Viper, when it faſtens either one or both its greater teeth in any part of the body, are an acute pain in the place wounded, with a ſwelling at firſt red, but afterwards livid, which by degrees ſpreads farther to the neighbouring parts; with great faintneſs, and a quick, though low, and ſometimes inter-

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(*m*) Oſſervazioni intorno alle vipere.

(*n*) Nouvelles experiences ſur la vipere.

(*o*) Philoſophical Tranſactions, vol. xii. N°. 144.

interrupted pulſe, great ſickneſs at the ſtomach, with bilious, convulſive vomitings, cold ſweats, and ſometimes pains about the navel; and if the cure be not ſpeedy, death itſelf, unleſs the ſtrength of nature prove ſufficient to overcome theſe diſorders: and though it does, the ſwelling ſtill continues inflamed for ſome time; nay, in ſome caſes more conſiderably upon the abating of the other ſymptoms, than at the begining. And often from the ſmall wound runs a ſanious liquor, and little puſtules are raiſed about it: the colour of the whole ſkin, in leſs than an hour, is changed yellow, as if the patient had the jaundice.

THESE miſchiefs (altho' different climates, the ſeaſon of the year more or leſs hot, the greater or leſſer rage of the Viper, the animal itſelf of a larger or ſmaller ſize, and conſequently able to communicate more or leſs venom, the wound made deeper, in a part more nervous or tendinous, and therefore receiving more of the poiſonous liquor, and the like circumſtances, may variouſly highten or abate them, yet) uſually diſcover themſelves much after the ſame manner in all: unleſs the bite happen not to be accompanied with the effuſion of that liquor, which is the main inſtrument and cauſe of this violent and ſhocking diſturbance.

But before I proceed to inquire into the nature and manner of the acting of this juice, it may not be improper to take notice, that the true uſe of it is to perform an office of ſo great moment to the preſervation of the individual, that without

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without it this creature could not ſubſiſt.

FOR Vipers live chiefly upon lizards, frogs, toads, mice, moles, and the like animals, which they do not chew, but ſwallow down whole; in which manner they lie in the ſtomach, or if that be not big enough to receive them, partly in that, and partly in the *oeſophagus*, which is membranous and capable of great diſtenſion; till by the ſalival juices of thoſe parts, together with the help of the fibres of the ſtomach, and the contraction of the muſcles of the *abdomen*, they are gradually diſſolved into a fluid ſubſtance, fit for the nouriſhment of their bodies, which is the work of many days. This is one reaſon why theſe creatures can live ſo long without taking any freſh food, which I have known them to do five or ſix months; as another is, that their blood is a groſſer and more viſcid fluid than that of moſt other animals: ſo that there is but a very little expence of it by tranſpiration, and conſequently leſs need of recruit. This not only microſcopes diſcover, but reaſon teaches: becauſe there is but very little muſcular force in the ſtomach to comminute the food, and make a chyle of fine parts; and therefore the blood muſt accordingly be of a tough and clammy conſiſtence. Beſides, the heart of a Viper has properly but one ventricle, and the circulation of the blood is performed after the ſame manner as it is in a frog and tortoiſe, in which not above one third of it paſſes through the lungs: upon which account its comminution in them by the air is proportionally leſſer than in other animals. Now ſuch a manner of feeding as this does neceſſarily require, that the prey ſhould upon the firſt catching be immediately killed: otherwiſe it were by no means fit to be let into the ſtomach. For we are not to think that the force of this part would be alone ſufficient to deſtroy it, the ſubtilty of a living creature (beſides the conſideration of the weakneſs of the fibres) being in a great meaſure able to elude that; as indeed we every day find live animals in the ventricles of others: and therefore to do this is the proper uſe both of the teeth and their poiſon; for which being deſigned and adapted, it is no wonder if the Viper, this ſame way by which it deſtroys its prey, proves ſometimes miſchievous to any other creatures beſides, when it happens to be enraged, or by any provocation ſtirred up to bite.

THE deſcription of the poiſonous fangs, their make, articulation and motion, as alſo of the glands that ſeparate the yellowiſh liquor, and the bags that contain it, I ſhall give, together with ſome anatomical obſervations, at the end of this diſcourſe.

THIS venomous juice itſelf is of ſo inconſiderable a quantity, that it is no more than one good drop that does the execution. And for this reaſon authors have contented themſelves with trials of the bite upon ſeveral animals, never eſſaying to examine the texture and make of the liquor itſelf: for which purpoſe I have oftentimes by holding a Viper advantageouſly, and enraging it till it ſtruck out its teeth, made it bite upon ſomewhat ſolid, ſo as to void its poiſon;

which carefully putting upon a glaſs plate, I have with a Microſcope, as nicely as I could, viewed its parts and compoſition.

UPON the firſt ſight I could diſcover nothing but a parcel of ſmall ſalts nimbly floating in the liquor; but in a very ſhort time the appearance was changed, and theſe ſaline particles were now ſhot out as it were into cryſtals of an incredible tenuity and ſharpneſs, with ſomething like knots here and there, from which they ſeemed to proceed: ſo that the whole texture did in a manner repreſent a ſpider's web, though infinitely finer, and more minute; and yet withall ſo rigid were theſe pellucid *ſpicula*, or darts, that they remained unaltered upon my glaſs for ſeveral months (*p*).

(*p*) Vid. Tab. i. Fig. 10.

I have tried ſeveral ways to find out, if I could, under what tribe of ſalts theſe cryſtals are to be ranged, and to diſcover what alterations they make in the blood: and not without ſome difficulty, by reaſon of the minute quantity of the liquor, and the hazard of experiments of this kind, ſome curious friends, and myſelf together, made the following obſervations.

ABOUT half an ounce of human blood received into a warm glaſs, in which were five or ſix grains of the viperine poiſon newly ejected, was not viſibly altered either in colour or conſiſtence: it then was, and remained undiſtinguiſhable from the ſame blood, taken into another glaſs, in which was no poiſon at all.

THESE portions of blood were ſeverally mixed with acids and alkali's: the empoiſoned blood was, after ſuch mixtures, of the ſame colour and conſiſtence as the other.

SPIRIT of nitre, ſpirit of ſalt, and juice of lemons, ſeverally poured upon the *ſanies* itſelf, produced neither fermentation, nor any change of colour.

SALT of tartar run *per deliquium*, and the ſimple ſpirit of hartſhorn, dropped upon the venom, neither altered its colour, nor raiſed any ebullition.

SYRUP of violets mixt with the poiſon did not change its colour either to red or green.

THE tincture of *heliotropium*, that is, blue paper, was not altered by the *ſanies* ejected upon it: and this drying ſtill retained its yellowiſh colour.

WE cauſed ſeveral animals, dogs, cats and pigeons; to be bit by an enraged Viper; which generally died, ſome in a longer, others in a ſhorter ſpace of time. But we conſtantly obſerved, that they all immediately upon the bite ſhewed, with ſigns of acute pain, marks of their life being affected by ſickneſs, faintings, convulſions, *etc.*

THE head of a large Viper lay three hours after it was cut off: it was perfectly flaccid and without motion. A pigeon wounded upon the breaſt with the fangs of this head, was preſently convulſed, *etc.* as from the bite of the animal, and died in ſeven hours.

WE contrived a ſharp ſteel needle to be made, crooked, in ſhape not unlike to the Viper's tooth, with a *ſulcus* or hollow on the convex part, not far from the point: into this we put a drop of the venom, and with it wounded the noſe of a young dog. It produced the uſual diſorders of vomiting, purging, *etc.* but in a leſs degree, and the dog recovered. It was remarkable, that upon making the wound the dog cried but little, till the poiſon came into it: but then he howled, *etc.* in the ſame manner as if bit by the Viper itſelf. But a pigeon pricked in the fleſhy part of the breaſt by the ſame poiſoned needle, ſuffered as from the bite, and died in about eight hours.

We made theſe laſt experiments, with a view to the controverſy between Signor *Redi* in *Italy*, and Monſieur *Charas* in *France*. The former, from trials of the ſame kind with thoſe we have now mentioned, affirmed that the venom of the Viper lay in the yellow liquor of the gums. The latter, in oppoſition to this, eſpouſed a notion advanced firſt by *Van Helmont*, and placed it altogether in the enraged ſpirits of the creature, calling this yellow liquor a pure innocent *ſaliva*; and alledged in proof of his aſſertion ſeveral experiments he made, with a ſucceſs quite different from that, with which Signor *Redi* made his.

THE moſt that can be concluded from hence, I think, is this, that although the Vipers in *Italy* do not differ in their nature from thoſe in *France*; yet there is a great deal of difference in the ſucceſs of the ſame experiments, when faithfully and judiciouſly made, and when they are cautiouſly and timorouſly managed, leſt they ſhould happen to overthrow a darling hypotheſis.

AND therefore, Monſieur *du Verney* in the Royal Academy, and Dr. *Areſkine*, then at *Paris*, confirmed the opinion of Signor *Redi*, by ſeveral trials which they made with the ſame effect: as I was afterwards informed by the Doctor himſelf.

WE reſolved to end our poiſon-inquiries by taſting the venomous liquor. Accordingly, having diluted a quantity of it with a very little warm water, ſeveral of us ventured to put ſome of it upon the tip of our tongues. We all agreed, that it taſted very ſharp and firey, as if the tongue had been ſtruck through with ſomething ſcalding or burning. This ſenſation went not off in two or three hours: and one gentleman, who would not be ſatisfied without trying a large drop undiluted, found his tongue ſwelled with a little inflammation, and the ſoreneſs laſted two days. But neither his nor our boldneſs was attended with any ill conſequence.

THIS is no objection to the hurtful quality of this juice: for as ſome chemical liquors ferment with others of a certain kind only; ſo theſe poiſonous ſalts may affect one fluid of the body, and not another. Which that is, we ſhall ſhew anon. It is ſufficient to the preſent purpoſe to ſay, that the ſaline *ſpicula* are broken and diſſolved in the mouth by the clammy ſalival humour: and if any of them ſhould paſs thence into the ſtomach and inteſtins, the balſam of the bile will be an antidote there, powerful enough to overcome their force.

THESE experiments upon the Viper poiſon and the blood, are a ſufficient confirmation of what has been advanced in the Introduction, that the nervous liquor only is affected by this venom; and at the ſame time afford a convincing proof, how much thoſe ſcanty principles of our chemiſts, acid and alkali, fall ſhort in explaining the actions of natural bodies: ſince neither of theſe ſalts could in any way be found to affect the viperine venom.

BEFORE I proceed, I muſt take notice, that even ſome of the ancients were thus far rightly appriſed of the nature of this poiſon. Of this *Galen* gives us teſtimony in ſeveral places; particularly in his book *De temperamentis*, (*q*) where he takes notice, that "nothing has "the ſame power upon the human "body outwardly as inwardly. "Thus, (ſays he) neither the venom of the viper, nor of the "aſp, nor frothy ſpittle of the "mad dog, are alike miſchievous "when they fall upon the ſkin,

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(*q*) Lib. iii. cap. 2.

“ or enter into the ſtomach, as
“ when outwardly communicated
“ by a wound.”

AND therefore *Lucan*, (who being an hiſtorical poet, makes amends for what is wanting of invention, by the ſpirit and judgment always ſhewn in his deſcriptions) introduces brave *Cato*, when marching the remains of *Pompey*'s army through *Africa*, very wiſely telling the ſoldiers, almoſt choaked with thirſt, yet afraid to drink of a ſpring they came to, becauſe full of ſerpents (*r*):

Noxia ſerpentum eſt admiſto ſanguine peſtis:
Morſu virus habent, et fatum dente minantur:
Pocula morte carent-----

(*r*) Lucan. Pharſal. lib. ix. ℣. 614

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Mixt with the blood, the ſerpent's poiſon kills;
The bite conveys it; death lurks in the teeth:
Swallow'd it works no harm------

IN the like manner it was in thoſe times alſo known, that the virulent juice had the ſame bad effects, when mixt with the juices of the body, by means of a common wound, as when communicated by the venomous bite. This made *Celſus* (*s*) adviſe, in ſucking out the poiſon, to take care there be no ulcer in the mouth: though this caution be rather ſlighted and ridiculed by *Severinus* (*t*) and others; who hereby diſcover how little they underſtood of the ſeat and nature of this poiſon. And *Galen* (*u*) mentioning the ſtory of

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(*s*) Loc. ante citat.

(*t*) Vipera Pythia, p. 361.

(*u*) De Theriac. ad Piſon. lib. i. c. 8. Vid. etiam c. 10.

Cleopatra, relates from other authors, that ſhe killed herſelf by pouring the *virus* of an aſp into a wound made in her arm by her own teeth.

IN ſhort, it is upon this foundation, that *Pliny* (*x*) aſſures us, the *Scythians* poiſoned their arrows with the *ſanies* of Vipers mixt with human blood. The way of doing it *Ariſtotle* (*y*) has at large related: and the *Tartars* are ſaid to uſe the like trick to this day. After the ſame manner the *Indians* make uſe of the venom of the lizard, called *Gecco*. This creature they hang up by the tail, and by whipping exaſperate till it diſcharge its *virus*, in which they tinge their darts: and a

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(*x*) Nat. Hiſt. lib. xi. c. 53. Scythae ſagittas tingunt viperinâ ſanie et humano ſanguine: irremediabile id ſcelus.

(*y*) De mirabilibus.

very ſlight wound with theſe weapons is ſpeedy death (z).

A later author, in his deſcription of the cape of *Good Hope*, (*a*) informs us, that the way by which the inhabitants there, called *Hottentots*, kill great wild beaſts, lions, tigers, elephants, *etc.* is this: they take the bladders of poiſon with their liquor out of the gums of that deadly kind of ſerpents, which the *Portugueſe* call *Cobras de Capello*: theſe they dry in the ſun, and grind them to powder betwixt two ſtones: this powder they make into a paſte with the ſpittle or ſlabber of the ſame creature: which paſte they rub upon the points of their darts, and lay them by to dry for their uſe.

(z) Bont. Hiſtor. Ind. lib. v. c. 5.

(*a*) Peter Kolben, printed at Norimberg, in High Dutch, 1719. pag. 532.

HAVING in the Introduction explained in general the manner in which this poiſon, in common with all others of the animal kind, acts upon the body; I ſhall only here add the reaſon of one particular effect of it, which is thought very extraordinary and ſurpriſing, that is, the *Jaundice.*

THE jaundice is a ſuffuſion of bile upon the ſurface of the body, and indeed upon all the inward membranes alſo. The *bile* is a natural *ſapo*, that is, a mixture of oil, water, and a ſalt both volatil and fixt, ſeparated in the liver. That the ſecretion of it may be rightly performed, it is requiſite (as in all animal ſecretions) that there be a due proportion of its

ſeveral

ſeveral parts, and alſo that there be a right diſpoſition of the ſecretory veſſels. Theſe compounding parts cannot be ſuppoſed to be altered in ſo ſhort a time as is here mentioned: but a conſtriction, or nervous ſpaſms, may almoſt ſuddenly ſo ſtreighten the orifices of the ducts, into which the bile is to paſs, that its derivation into them will be ſtopt; and conſequently it muſt remain in the blood, which in the courſe of circulation will diſcharge it upon the whole body.

THIS is a jaundice of the ſame kind with that which follows ſometimes upon violent colic pains, in which the ſpaſmodic contraction of the membranes of the *abdomen* interrupts the motion of the bile through the hepatic canals: the cure of which therefore is by plentiful dilution and anodyne medicines.

THE caſe is quite otherwiſe in the common jaundice, which is a diſeaſe of the liver. In this the fault lies in the bile itſelf. For though it is uſually ſaid, that this is an obſtruction in the liver; yet it ought to be conſidered, that the veſſels are rarely obſtructed but by the diſorder of the liquors they carry; and conſequently that an ill ſtate of the bile muſt be, except in ſome extraordinary caſes, antecedent to an obſtruction in its ducts: and therefore, as the alterations of ſo compounded a fluid are different, ſo the jaundice is accordingly attended with different, nay ſometimes with contrary ſymptoms. In ſome caſes, without a fever, the *faeces* of the inteſtins are hard and white with great coſtiveneſs: in others a *Diarrhoea* with a fever, and yellow diſcharges, weakens the patient. In the former (the conſequent generally of an inactive ſedentary life) for want of a due quantity of ſalt, the oily part of the bile grows viſcid and thick, and ſtagnates in the ducts of the liver: in the other (owing to plentiful living, and drinking ſpirituous liquors) the volatil part of the ſalt prevails too much, and the bile becomes too thin, hot, and irritating.

THERE is another diſeaſe, which though it be thought to belong to another part, yet is indeed ſo much a-kin to the jaundice, that it may be properly mentioned on this occaſion, I mean the *Diabetes*. For this is not, as phyſicians have commonly judged, a diſtemper of the kidneys, but of the liver, proceeding likewiſe from a vitiated mixture of the bile. It happens moſt frequently to thoſe, who without due exerciſe indulge themſelves in drinking vinous liquors, and then quench their thirſt ariſing from theſe, by too great a quantity of ſuch as are cooling.

BY ſuch ill-timed heating and cooling of the humors of the body, the natural proportion of ſalt in the bile, by which its oily part is incorporated with the water, is not ſufficient, now the water overabounds, to preſerve the mixture: ſo that a great portion of this, together with ſome of the thinneſt of the oil, will be diſcharged by the kidneys; and the urinary ducts will be greatly enlarged by a conſtant afflux that way. By which means the thicker oily particles are left in a degree of coagulation in the ſmaller tubes of the liver, and are there formed into a hard fatty ſubſtance.

THE diſſection of thoſe, who have died of the *Diabetes*, proves this to be ſo: for I have always found a *Steatomatous* collection in their liver, in appearance not unlike to what is often diſcharged by ſtools in a confirmed jaundice, but of a harder conſiſtence.

As to the ſweetneſs of the urine, this is all bilious: for the water of the bile ſeparated from its ſalt is ſweet. *Ox Gall*, by a chemical diſtillation, yields four parts in five of water (*b*). This I have obſerved to be fragrant, as if perfumed with Muſk. The urine in the be-

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(*b*) Vid. Haller. Not. in Boerhaav. Inſtitut. Medic. §. 99.

gining of a jaundice very often ſmells like violets; and in a *Diabetes* the flux is uſually leſſened towards the latter end of life, and the water is as bitter as gall: plain indications of a like origin of two diſtempers ſeemingly very different. Neither can I omit to take notice, that the cure of a *Diabetes* confirms theſe remarks: for this is chiefly done by ſupplying the blood with a quantity of fixt ſalt, particularly ſuch as is contained in lime water, and in that of the hot well at *Briſtol*, which is indeed a natural lime water. But what might be ſaid on this ſubject would require a juſt diſcourſe. It is time to come to the cure of the Viper-poiſon.

THERE was formerly in *Africa* a nation of people called *Pſylli*, famous for the cure of the bite of ſerpents, with which that country above all others abounds. Theſe people were thought to have ſomething in their conſtitution ſo contrary to poiſon, that no venomous creature would touch them: and it was pretended, that they made this a trial of the legitimacy of their children. The truth of the matter is: they performed the cure in a manner very ſurpriſing to the vulgar, that is, by applying their mouth to the wound, and ſucking out the venom. The *Marſi* in *Italy* pretended to the ſame power (*c*). Some ceremonies, to over-awe the patient, and gain reverence to the operator, were added to the performance: but *Celſus*, the Latin *Hippocrates*,

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(*c*) Vid. Plin. Hiſt. Nat. lib. vii. c. 2. Ælian. Hiſt. Animal. lib. i. c. 57. Et Lucan. lib. ix. ℣. 891.

has wiſely obſerved, that "Theſe "*Pſylli* had no particular ſkill "in this management, but boldneſs confirmed by uſe: for the "poiſon of the ſerpent, as likewiſe "ſome hunting poiſons, which the "*Gauls* particularly make uſe of, "are not hurtful in the mouth, "but in a wound. Therefore "whoſoever will, after their example, ſuck the wound, will "be in no danger himſelf, and "will ſave the life of the wounded "perſon (*d*). *Ariſtotle* has hinted ſomething to this purpoſe. "The "ſpittle of a man (ſays he) is an

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(*d*) Neque hercule ſcientiam praecipuam habent hi, qui Pſylli nominantur, ſed audaciam uſu ipſo confirmatam. Nam venenum ſerpentis, ut quaedam etiam venatoria venena, quibus Galli praecipue utuntur, non guſtu, ſed in vulnere nocent. Ergo quiſquis, exemplum Pſylli ſecutus, id vulnus exſuxerit, et ipſe tutus erit, et tutum hominem praeſtabit. Medicin. lib. v. c. 27.

“ enemy to the bites of moſt “ ſerpents (*e*). And *Nicander* obſerves, “ That ſerpents fly from “ even the ſmell of human ſpit- “ tle (*f*).

PLINY expreſſes the thing ſtill in a ſtronger manner, and affirms, “ That there is in all men a poi- “ ſon, which kills ſerpents: and “ that theſe creatures run away “ from ſpittle, as they will from “ the touch of ſcalding water (*g*).

IT may therefore juſtly ſeem ſtrange, that, upon ſo good an authority as that of *Celſus*, (who ge-

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(*e*) Hiſtor. Animal. lib. viii. c. 29.

(*f*) Πολλάκι ϗ βροτέων σιάλων ὑποέτρεσαν ὀδμήν. Theriac. ℣. 86.

(*g*) Omnibus hominibus contra ſerpentes ineſt venenum, feruntque ictum ſalivae, ut ferventis aquae contactum, fugere. Loc. citat.

nerally gives us the methods of the *Greek* phyſicians and ſurgeons) ſo beneficial and eaſy a practice as this of the *Pſylli* ſhould not have been perpetuated by phyſicians. But the notion, that a poiſon ſo fatal in a wound, could not be taken into the mouth without hurt, was, no doubt, the obſtacle: eſpecially when it was imagined, that outward applications would anſwer the purpoſe as well, without any hazard.

HOWEVER, this method of cure ought, I think, to be revived: and there happened, about three years ago in *London*, a very remarkable caſe, which confirms the ſucceſs of it.

THE ſtory is this, as related to me by an ingenious and experienced ſurgeon, who ſaw the caſe at the latter end of it. A man was bit on one of his fingers by a *Rattle-ſnake*, juſt then brought over from *Virginia*. He immediately put his finger into his mouth, and ſucked the wound. His under-lip and tongue were preſently ſwelled to a great degree: he faultered in his ſpeech, and in ſome meaſure loſt his ſenſes. He then drank a large quantity of oil, and warm water upon it, by which he vomited plentifully. A live pigeon was cut in two, and applied to the finger. Two hours after this, the fleſh about the wound was cut out, and the part burnt with a hot iron, and the arm embrocated with warm oil. He then recovered his ſpeech and his ſenſes. His arm continued ſwelled the next day, but by common applications ſoon grew eaſy, and the patient ſuffered no farther miſchief.

As the poiſon of this Snake is more quick and deadly than any other, that we know; a remedy for this will moſt certainly prove effectual againſt that of ſmaller Vipers, and all other creatures of this kind. The other applications here made uſe of (the vomit excepted) could be of no ſervice. The pigeon; the cutting and burning the part, two hours after the wound had been made; did no good. Embrocating the arm with oil only abated the ſwelling. Therefore the phyſicians of the Royal Academy at *Paris* gave a right judgment of this application, in a like caſe. An account having been given in our Philoſophical Tranſactions *(h)* of an experiment made, in which it was pretended that common oil, rubbed into the wound, had cured the bite of a Viper; they with all poſſible care made ſeveral trials with it, and pronounced it to be ineffectual; any farther than as it might be a fomentation to the tumefied part *(i)*.

THE firſt thing then to be done upon the bite of a Viper, of any kind, is that the patient ſhould immediately ſuck the wound himſelf, if he can come at it: if he cannot, another perſon ſhould do this good office for him. Whoever does it, ought (to prevent any inflammation of the lips and tongue, from the heat of the poiſon) to waſh his mouth well before-

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(*h*) N°. 443.
(*i*) Mem. Acad. Sc. Par. an. 1737.

hand with warm oil, and hold ſome of this in the mouth while the ſuction is performing.

AFTER this is over, it will be proper to give a vomit. A doſe of *Rad. Ipecacuan.* encouraged in the working with oil and warm water, may be ſufficient. The good effect of this is owing to the ſhake, which the action of vomiting gives to the nerves; whereby the irregular *ſpaſms*, into which their whole ſyſtem might be drawn, are prevented.

TO confirm this practice, I have been aſſured by an ingenious ſurgeon, who lived in *Virginia*, that the *Indians* there cure the bite of the *Rattle-ſnake*, by ſucking the wound, and taking immediately a large quantity of a decoction of the *Seneca Rattle-ſnake Root*, (which vomits plentifully) and laying to the part the ſame root chewed.

As to any other external management, I think it can avail but little: ſince it cannot prevent the ſudden communication of the poiſon to the nerves. Burning the part with a hot iron is of no uſe. Dry ſalt upon the wound, recommended by *Celſus (k)*, promiſes ſomewhat more, but not much. The celebrated Snake-ſtones, brought from the *Eaſt-Indies*, and ſaid to be taken out of the head of the *Cobra de Capello*, have no virtue to be depended on. This Signor *Redi (l)*, Monſieur *Charas (m)*, and my ſelf have expe-

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(*k*) Lib. v. c. 27.
(*l*) Eſperienze intorno alle coſe naturali.
(*m*) Pag. 66.

rienced. They will indeed, when applied, ſtick to the wound for ſome time; being, as appears from their make, not natural but factitious bodies, compounded moſt probably of calcined bones, and ſome teſtaceous ſubſtances mixt together: but when they drop off, they are found to have imbibed nothing of the venom.

MORE is to be ſaid for the remedy of our Viper-catchers, in which they place ſo much confidence, as to be no more afraid of a bite than of a common puncture; immediately curing themſelves by the application of their ſpecific.

THIS, tho' they keep it as a great ſecret, I have however upon ſtrict inquiry found out to be no other than the *Axungia Viperina* preſently rubbed into the wound. And to convince my ſelf of its good effects, I enraged a Viper to bite a young dog in the noſe: both the teeth were ſtruck deep in; he howled bitterly, and the part began to ſwell: I diligently applied ſome of the *Axungia* I had ready at hand, and he was very well the next day.

BUT becauſe ſome gentlemen, who ſaw this experiment, were apt to impute the cure rather to the dog's ſpittle (he licking the wound) than to the virtue of the *fat*; we made him to be bit again in the tongue, forbearing the uſe of our remedy; and he died within four or five hours.

AT another time I made the like trial with the ſame ſucceſs.

As this *Axungia* conſiſts of clammy and viſcid parts, which are withall more penetrating and active than moſt oily ſubſtances; ſo theſe, without all doubt, may, if immediately applied, involve, and as it were ſheath, the volatil ſalts of the venomous liquor, and thus prevent their ſhooting out into thoſe cryſtalline *ſpicula*, which we have obſerved to be the main inſtruments of that deadly miſchief, that attends the bite.

BUT even this cure ought not to be relied on. 'Tis ſafeſt to uſe the method we have mentioned: and moreover, if the patient feels any ſickneſs, faintneſs, or any of the nervous ſymptoms we have deſcribed; he muſt be put into bed, and a ſweat muſt be promoted by cordial medicines, particularly the

Confect. Ralegh. and the ſalt of Vipers, or, in want of this, ſalt of Hartſhorn, given in warm wine. I have often experienced the good effects of this proceeding: and, after all the pretenſions of the cure by oil, in the caſe above related (*u*), the man was really not recovered without theſe means.

I SHALL conclude with ſome hints, concerning the uſe of the Viper in phyſic: becauſe authors are very large in enumerating its virtues againſt many, and ſome of them, very obſtinate diſtempers.

ONE of the firſt, whom we find in antiquity to have made uſe of the fleſh of this creature to medicinal purpoſes, was, I think, *Antonius*

(*u*) Phil. Tranſact. N°. 443.

tonius Muſa, the famous phyſician to *Octavius Caeſar*; of whom *Pliny* (*o*) tells us, "That when he met "with incurable ulcers, he or"dered the eating of Vipers, and "by this means they were quickly "healed."

IT is not improbable, that he might have learned this from the great *Greek* phyſician *Craterus*, mentioned often by *Cicero* in his epiſtles to *Atticus*; who, as *Porphyrius* (*p*) relates, "very happily "cured a miſerable ſlave, whoſe "ſkin in a ſtrange manner fell off "from his bones, by adviſing him "to feed upon Vipers dreſſed after "the manner of fiſh."

(*o*) Lib. xxx. c. 13.
(*p*) De abſtinent. ab animal. lib. i. p. 16.

BE this as it will, in *Galen's* time the profitable qualities of the Viper were very commonly known. He ſays, that they, who are afflicted with the *Elephantiaſis*, are wonderfully relieved by eating Vipers, dreſſed like eels: and relates very remarkable ſtories of cures of this diſeaſe, performed by the Viper-wine (*q*).

ARETAEUS, who moſt probably lived about the ſame time with *Galen*, and of all the ancients has moſt accurately deſcribed the *Elephantiaſis*, commends, as *Craterus* did, the eating of Vipers inſtead of fiſh in the ſame diſeaſe (*r*). And to this

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(*q*) De arte curat. ad Glauc. lib. ii. c. 10. et De ſimpl. medic. facult. lib. xi. c. 1.

(*r*) Curat. diuturn. lib. ii. c. 13.

this purpoſe I remember, that as *Lopes* (*s*), in his relation of the kingdom of *Congo* in *Africa*, takes notice how greedily the negroes eat adders, roaſting them, and eſteeming them as the moſt delicious food; ſo *Dampier* (*t*) alſo informs us, that the natives of *Tonquin* in the *Eaſt Indies* treat their friends with arack, in which ſnakes and ſcorpions have been infuſed, accounting this not only a great cordial, but alſo an antidote againſt the leproſy, and all other ſorts of poiſon.

I HAVE ſince been told by a learned phyſician, who reſided many years at *Bengal*, that it is a

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(*s*) Vid. Purchas's Pilgrims, part II. book vii. chap. 4. § 3.

(*t*) Voyages, Vol. II. part I. p. 53.

conſtant practice there to order in diet the *Cobra de Capello* (the Viper of that country) to perſons waſted by long diſtempers.

THE phyſicians in *Italy* and *France* very commonly preſcribe the broth and gelly of Vipers fleſh for much the ſame uſes, that is, to invigorate and purify the maſs of blood exhauſted with diſeaſes, or tainted with ſome vicious and obſtinate ferment.

FROM all this it appears, that the main efficacy of the viperine fleſh is to quicken the circle of the blood, promote its due mixture, and by this means cleanſe and ſcour the glands of thoſe ſtagnating juices, which, turning to acidity, are the origin of many, at leaſt, of thoſe troubleſome diſtempers in the ſurface of the body, which go under the names of ſcrophulous, leprous, *etc.*

THESE good effects are owing to that penetrating, ſtrong ſalt, with which the ſubſtance of theſe creatures does, in a very great proportion, abound; and the reaſon of this is from the food they live on, which we have obſerved before to be lizards, moles, *etc.* whoſe nature every one knows to be ſuch as muſt neceſſarily, when they are diſſolved in the ſtomach, ſupply the blood with a great quantity of active and volatil parts. And herein lies the difference between the fleſh of Vipers, and that of other innocent ſerpents, which feeding chiefly upon graſs, herbs, *etc.* do not recommend themſelves to us by any of thoſe properties, which are in ſo eminent a degree found in the former.

WHOSOEVER reflects on what has been ſaid on this head, will very readily acknowledge, that our phyſicians deal too cautiouſly or ſparingly with a remedy, which may be applied to very good purpoſes, when they preſcribe a few grains of the powder of dried Vipers, or make up a ſmall quantity of their fleſh into *Troches*. Whereas, that ſervice may really be done this way, the patient ought to eat frequently of Viper gelly, or broth; or rather, as the ancient manner was, to boil Vipers, and eat them like fiſh; or if this food will not go down, (tho' really very good and delicious fare) to make uſe at leaſt of wine, in which dried Vipers have been digeſted ſix or ſeven days, in a gentle heat (*v*), from which I have ſeen very good effects in obſtinate *lepra's*; or laſtly, (in ſome caſes eſpecially, where wine is not convenient) to take either the powder, or good quantities of the viperine ſalt, in which alone the virtue of all medicines made from this creature reſides. And therefore the ſalt of any other animal, which is ſtill more pungent and ſtimulating than this, (as is particularly that of *Cantharides*) is yet a more powerful remedy in dry and ſcaly *leprous* eruptions; which may without any inconvenience be given in the form of a *Tincture* made with ſpirit of wine (*x*).

(*v*) Vid. Pharmacop. Lond.
(*x*) Vid. eand. Pharmacop.

An APPENDIX,

CONTAINING

An anatomical deſcription of thoſe parts in a Viper, and in a Rattle-ſnake, which are concerned in their Poiſon:

WITH

A ſhort ACCOUNT of ſome other venomous Animals.

IN order to give a full view of the inſtruments of death in a Viper, and that larger ſpecies of it, the Rattle-ſnake, I ſhall explain the figures drawn from diſſections of them both, begining with the leſſer animal, and ending with the bigger. And if ſome things are repeated in the latter, which had been obſerved in the former, this will

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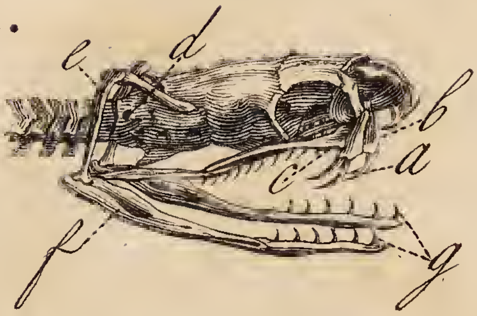
Tab: 1.

Fig. 1.



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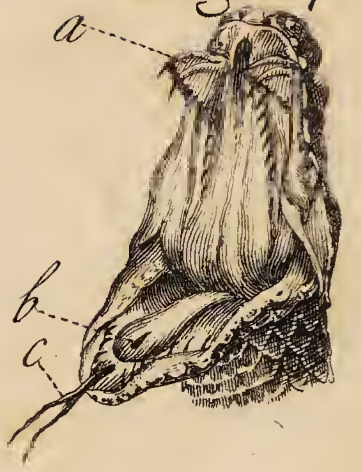

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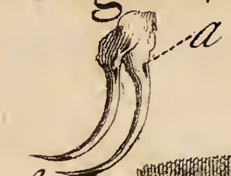

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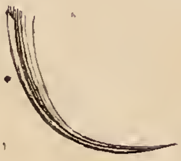

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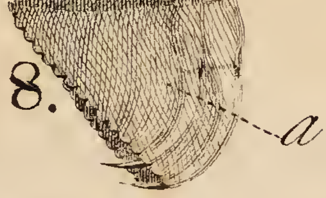

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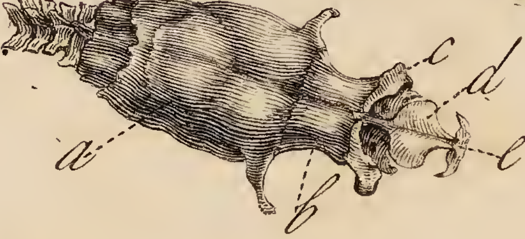


Fig. 9.

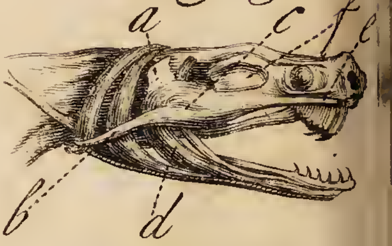


Fig. 5.

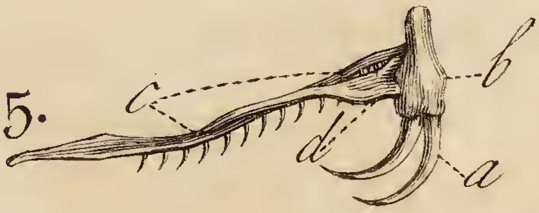


Fig. 10.

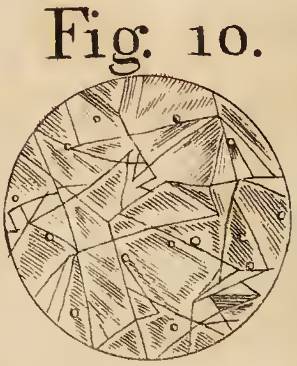
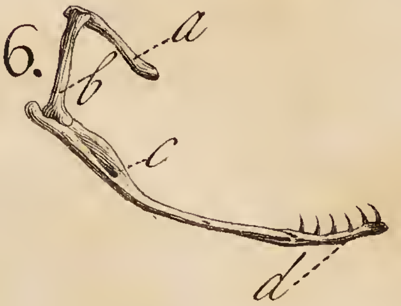


Fig. 6.



will not be thought tedious: becauſe in ſubjects ſo minute, it is ſometimes neceſſary to repreſent the ſame parts in different ſituations and connexions, that the uſes aſſigned to them may be the more clearly underſtood. And for this reaſon, I ſhall not follow the order of the figures, ſo much as I ſhall the thread of the deſcription, which they are deſigned to explain.

TABLE I.

EXHIBITS ſeveral views taken from the head of the common Viper.

FIG. 1. ſhews a ſide view of the ſkull and jaws: in which

a. REPRESENTS two poiſoning fangs on each ſide, fixed (in a manner to be deſcribed hereafter) in a ſolid bone on each ſide *b.*

Theſe ſolid bones are articulated by a *ginglymus*, as it were pendent to the two *zygomata*: upon which, with the poiſoning fangs, they receive two motions; *viz.* production, by which the fangs are erected; and retraction, by which theſe fangs are brought in, and couched againſt the roof of the mouth, ſo as to admit of cloſing the jaws.

FIG. 5. *a.* ſhews theſe fangs magnified.

THESE motions are produc'd by a thin ſlip of bone, Fig. 1. *c.* and Fig. 5. *d.* which being connected to the bone *b.* below its articulation, makes it to join in the motions of production and retraction, which it receives itſelf by being connected to the bone, Fig. 5. *c.* which is produced and retracted as well in conjunction with the under jaw, to which it is connected, as by the action of muſcles properly formed and ſubſervient to itſelf.

Fig. 1. *f.* ſhews the under jaw, and

d, *e*, its two *fulcra*, by the help of which it receives variety of motions neceſſary in ſwallowing its prey.

Fig. 6. ſhews theſe two *fulcra* *a* and *b*, by the intervention of which the under jaw is connected to the *ſinciput* and temporal bone.

In order to underſtand the manner, by which the Viper ſwallows its prey, it muſt be obſerved, that the upper and lower jaw on one ſide move independently of the upper and lower jaw on the oppoſite ſide; ſo as that the upper and lower on one ſide can be protruded or retracted, while the correſpondent parts on the oppoſite ſide are either employed in contrary motions, or held firm and unmoved: and being furniſhed with ſmall teeth firmly connected to their ſurfaces, which from their office we may term holders, Fig. 1. *g.* and Fig. 5. *c.* they are capable of drawing down their prey, by alternately retracting the two jaws on each ſide.

These holders are more numerous in the upper, than in the lower jaw.

Fig. 5. *c.* ſhews them in the upper jaw.

Fig. 6. *d.* ſhews them in the lower.

Fig. 4. ſhews the top of the ſkull: in which

a. The *ſinciput* is compoſed of one bone, which in man is formed by the concurrence of the two parietal bones: whereas the *frons b*, which in man is one bone, is in this animal divided into two by a ſuture.

c. SHEWS the anterior edges of the orbit of the eye formed by the frontal bone.

d. THE *oſſa naſi.*

e. THE maxillary bone in this animal no way divided.

BEFORE we leave the bones of this part, we muſt obſerve, that the poiſoning fangs are different from the holders in other circumſtances, beſides their magnitude and motions. And firſt I muſt remark, that, though there are two poiſoning fangs on each ſide; yet it rarely happens, that they are both firmly fixed in the ſockets deſigned for their reception. I have obſerved ſometimes, that the external fang on each ſide was looſe, and ſometimes the internal fang on each ſide was looſe; and ſometimes the internal on one ſide, and the external on the other ſide were looſe: and that, in protruding the fangs, that, which was firmly fixed, was more erected, than that which was looſe; which it likewiſe always exceeded in length. From all theſe conſiderations, joined to ſome circumſtances hereafter to be explained, I have been induced to believe, that the Viper employs but one fang at a time; nature having ſo contrived, that the whole poiſon prepared on one ſide ſhall as effectually be lodged in the prey by the action of one fang, as by both, and thus be ſufficient to anſwer its purpoſe.

As the fang of the Viper deſcribes an arch of a circle in wound-

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ing its prey, ſo its force and ſtrength are greatly ſecured by its curve form, reſembling nearly the claw of a bird, Fig. 1. *a*, and Fig. 5. *a*. But as this form is neceſſarily attended with a great difficulty in diſengaging it again from the part, into which it is ſtruck; it muſt often happen, that its prey, in ſpringing away on being wounded, muſt break off the fang: and the rather becauſe the Viper, finding itſelf pulled away by the motions of its prey, will probably laſh about its tail; till, fixing it ſelf by it, the fang is obliged either to diſengage it ſelf, or to break off ſhort at the ſocket, which is its weakeſt part. To remedy this inconvenience, the fang, which before was looſe, probably ſoon becomes fixed; and the broken fang falling out, another new one is fixed (though looſely) in its place.

For, to ſupply this loſs or breaking of fangs, we always find a cluſter of young fangs of different degrees of perfection, lodged in the bag near the roots of the poiſoning fangs: of which I have counted ſix on one ſide in a Rattleſnake. I ſhall not attempt to conjecture, by what means theſe ſubſidiary fangs are from time to time conducted to the empty ſockets; the ſeveral circumſtances mentioned being ſufficient to incline us to believe, that they ſerve for that purpoſe: as the life of the animal manifeſtly requires ſuch a ſupply for its preſervation.

These poiſoning fangs are hollow from near the edge of the ſocket to near the point. This hollow begins by an orifice in the fore part of the tooth, Fig. 2. *a.* and terminates at ſome diſtance above the *apex b*; from whence the fang is exceeding hard and ſolid, and ſloped off, ſo as to reſemble in ſome meaſure the common tooth-pick.

Fig. 3. repreſents this hollow of the tooth, by ſpliting it through its *axis*.

The *apparatus* for preparing and injecting the poiſonous fluid conſiſts in a gland, Fig. 9. *c*. ſituated on each cheek: in which ſituation it is firmly connected to the *ſinciput* at its commiſſure with the *occiput* by the ligament *a*, and to the poſterior extremity of the lower jaw by the ligament *b*. From theſe ligaments continued on its ſurface the gland is furniſhed with a ſtrong albugineous coat, proper to ſtrengthen it againſt the great diſtenſions, which it muſt ſuffer in accumulating its fluid, and the violent compreſſions in emitting it.

The ſame integument continued on forms the excretory duct *e*, by which the poiſon is conveyed from the gland into the cavity of the erected fang, by the aſſiſtance of a bag or purſe, Fig. 7, and 8,*a*. in which the two poiſoning fangs are on each ſide contained.

f. Shews a ſmall white gland, which, from its ſituation near the fangs, has been ſuppoſed to be the organ for ſecreting the poiſon: though probably it is no more than either a lymphatic, or a ſalival, gland; and is entirely wanting in the Rattle-ſnake.

All the muſcles ſubſervient to the action of biting are in this animal

nimal ſo ſituated, as to bear ſtrongly upon the poiſon gland during their action; thereby conſpiring to ejaculate its fluid.

BUT the chief part in this ejaculation of the poiſon is performed by the muſcle *d*, which ariſing from the inferior *maxilla* runs obliquely upwards under the poiſon gland, till paſſing between the two ligaments *a* and *b*, it reflects itſelf upon the external ſide of the gland, and running parallel with its length, is firmly attached to it. By the aſſiſtance of the ligament *a*, which in ſome meaſure ſerves as its tendon, this muſcle muſt contribute to cloſing the jaws: but its greateſt action is to ſqueeze the poiſon gland, which it nearly ſurrounds; in the ſame manner as we uſually ſqueeze an orange, in order to expreſs its juice. The diſpoſition of this muſcle upon the ſurface of the gland in a continued courſe with the direction of its duct, and the terminating of this duct (which appears tendinous) at the roots of the fangs, were circumſtances, which raiſed an opinion, that this was altogether a muſcle ſubſervient to their retraction: the contrary of which will however appear by immerging the head, when excoriated, in hot water; after which the muſcle will eaſily ſeparate, and leave the gland naked to view.

Fig. 7. ſhews the head of the Viper not diſſected: in which

a. Shews the two poiſoning fangs on each ſide incloſed in their proper bags, in which the different degrees of extenſion, or erection, are eaſily obſerved.

b. Shews the entrance into the *Trachea*, ſo ſituated, as to be leaſt liable to being compreſs'd in the action of ſwallowing.

c. Shews the tongue, by which the Viper laps the dew; and by whoſe action poſſibly the ſubſidiary fangs are placed in the empty ſockets, as occaſion may require.

Fig. 8. repreſents the bag enveloping the two fangs, as it appears when conſiderably magnified; whereby the fimbriated or ſcalloped edge is more diſtinguiſhable. But the particular ſtructure and office of this bag will be better explained, by viewing it bigger in the *Rattle-ſnake.*

TABLE II.

SHEWS five views taken from the head of an exceeding large *Rattle-ſnake*: of which

FIG. I. *a.* repreſents the maxillary bone.

b. THE *oſſa naſi.*

c. THE *os ſphenoeides.*

d. THE *os ſincipitis.*

e. THE two *oſſa frontis.*

f. THE *os temporum*, with the *os auditûs* like that of birds, but ſtanding nearly parallel to the ſpine.

g. THE *os occipitis.*

h, and *i.* THE two *fulcra* of the inferior *maxilla.*

k. THE bone, in whoſe ſockets the two poiſoning fangs are received, connected by a *ginglymus* to

l. THE *zygoma.*

m, m.

Tab: II.

Fig: 1.

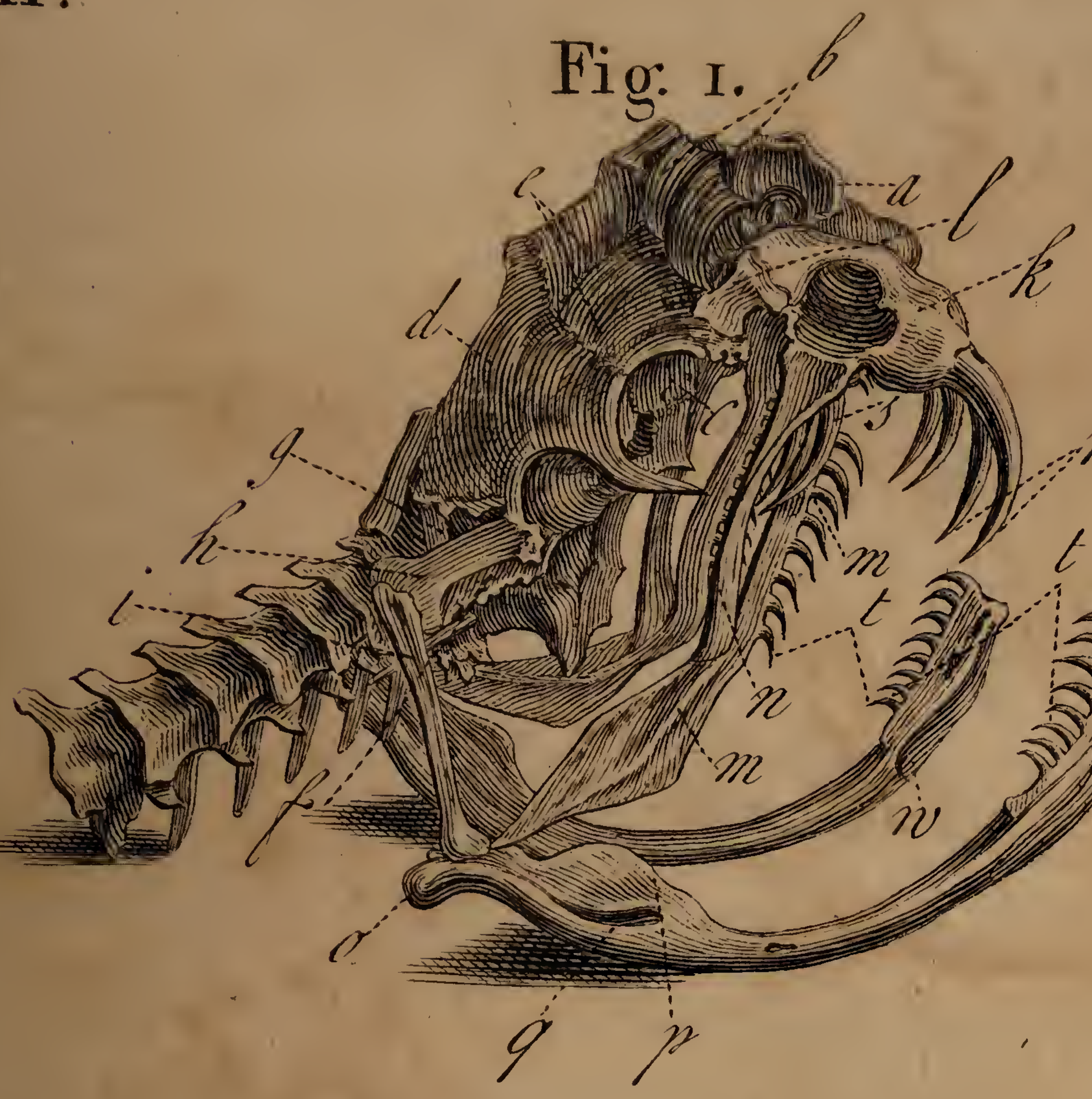


Fig: 3.

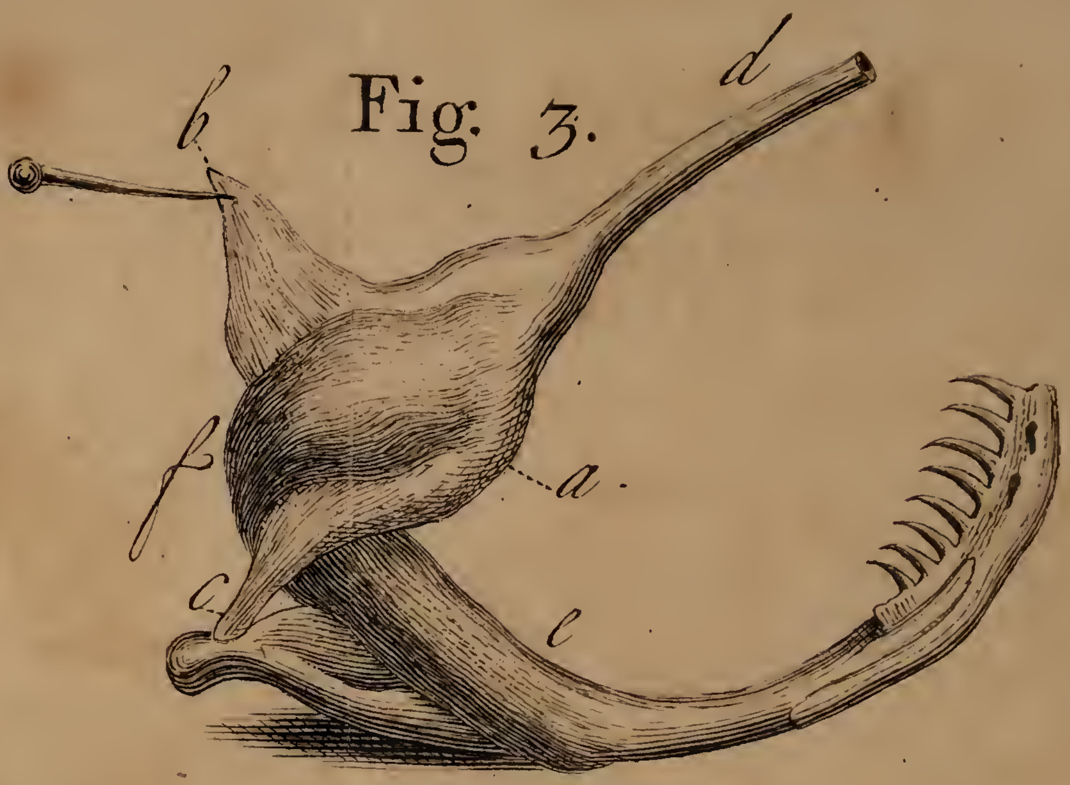


Fig. 5.

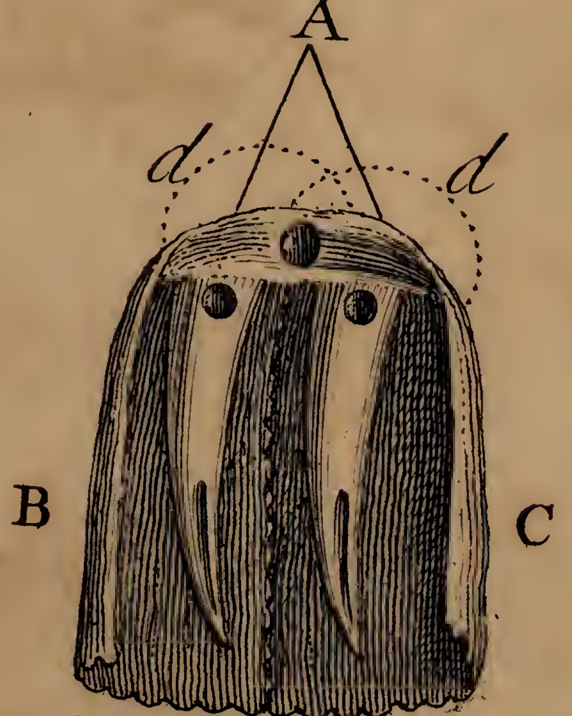


Fig. 2.

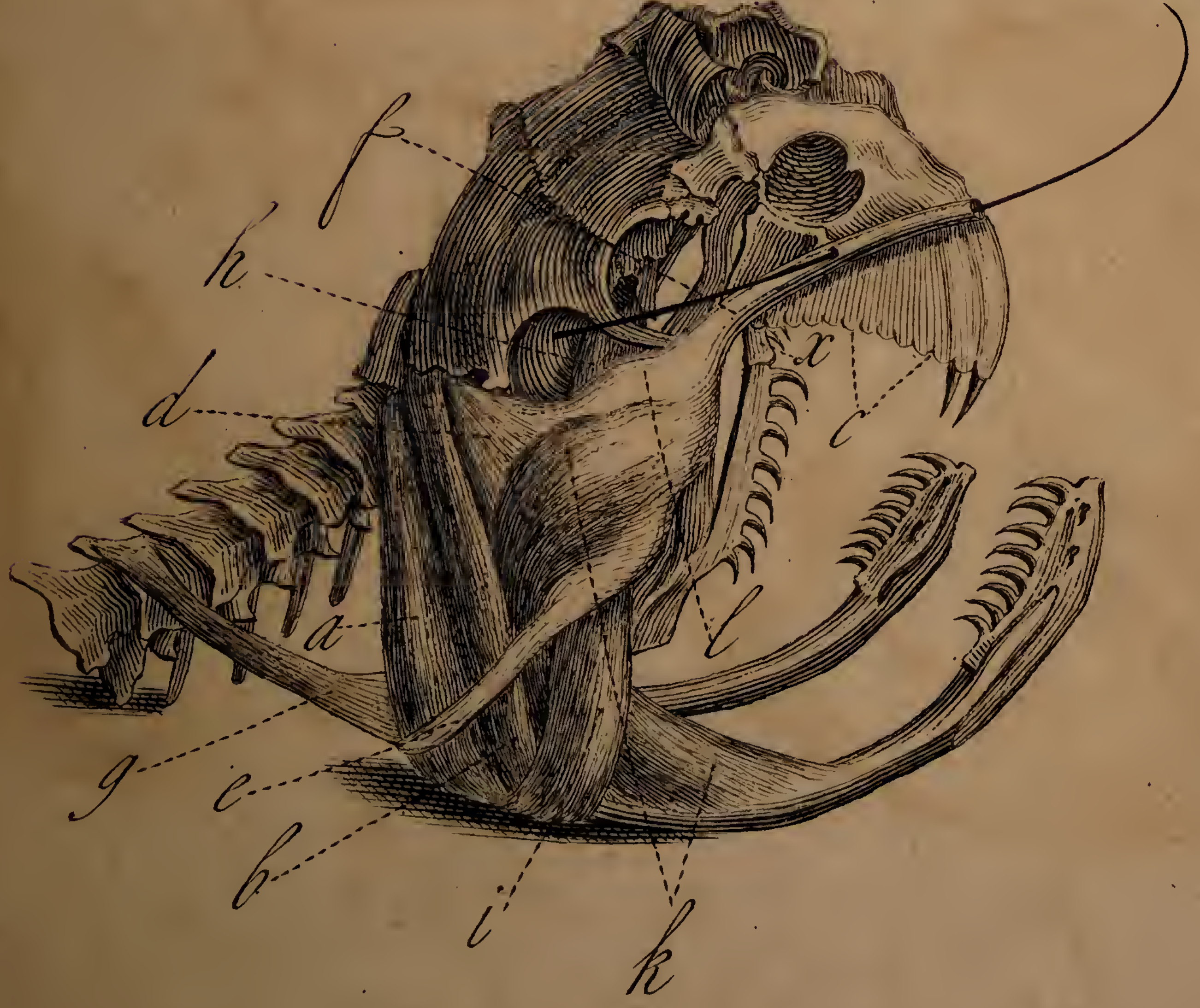
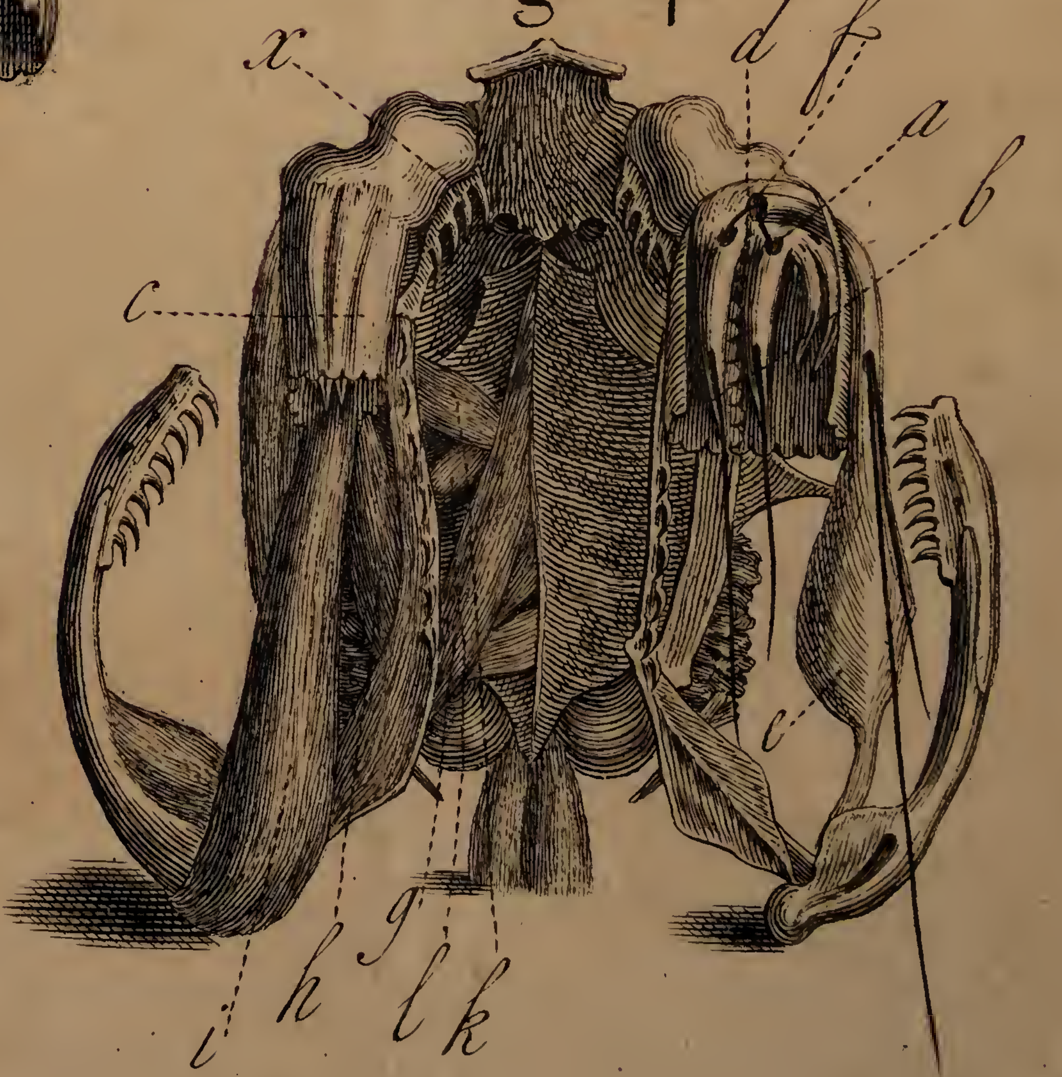


Fig. 4.



G. King ad vivum delin: et sculp:

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m, m. THE moveable bone of the upper jaw furniſhed with its holders; in which bone a joint may be obſerved at Fig. 2, *x.* at which joint it becomes curved, when

n. FIG. I. a ſmall ſplinter of bone, connected by one extremity to the former, and by the other to the bone containing the fangs, is ſo protruded, as to erect the fangs.

o. THE poſterior extremity of the under jaw extended beyond its *fulcrum*, in order to increaſe the power of a ſmall muſcle ſerving to open it, Fig. 2. *g*.

p. SHEWS a proceſs of the under jaw analogous to the *corone* in other animals, into which the great elevator is inſerted.

BELOW this proceſs externally may be obſerved a large *foramen*, *q.* by which the blood-veſſels and nerves enter: which, after ſupplying branches to the *perioſteum* and medullary ſubſtance, paſs out again at a large internal *foramen*, *w*. Fig. 1. leaving ſome few twigs, which proceeding further paſs out at two ſmall *foramina*, *u*. and are ſpent upon the gums and under lip.

t, *t*. SHEW the holders in each jaw, which do not appear to be connected by a gomphotic articulation, but fixed by ligaments into ſhallow pits or inequalities deſigned for their reception.

r. SHEWS the poiſoning fangs fixed in their ſockets, as they appear when almoſt fully erected. For a ſupply of theſe fangs, when accidentally broke out,

s. SHEWS ſeveral ſubſidiary teeth of different magnitudes in their natural ſituation.

Fig. 2. ſhews the ſame head, with its poiſon gland, and the ſeveral muſcles ſubſervient to the motions of the jaws, as they appear in their natural ſituation.

a. Shews a muſcle, which, by being inſerted behind its *fulcrum*, ſerves to open the under jaw.

b. A muſcle inſerted immediately before its *fulcrum*, ſerving to elevate or cloſe the jaw.

But the moſt active muſcle in cloſing the mouth and jaws ſeems to be *h*, *i*. which ariſing from the *os ſincipitis*, and paſſing down behind the poiſon gland, is inſerted into the under jaw at ſuch a diſtance from its *fulcrum*, as to have the advantage of all the other muſcles.

d and *e*. SHEW the two ligaments, by which the gland is fixed to the edge of the *ſinciput* and the extremity of the under jaw.

l. SHEWS the body of the poiſon gland, covered by an albugineous coat formed by an expanſion of the two ligaments mentioned.

THE ſame albugineous coat continued forms a large duct, *f*. by which the poiſonous fluid is conveyed from the gland to the bag *c*. which envelops the poiſoning fangs.

NOW, although it has been obſerved, that the muſcles *b*, and *b*, *i*. are ſo ſituated as to bear againſt the gland during their action, thereby aſſiſting to expel the poiſon; yet the greateſt power in expelling the poiſon ſeems to be in the action of the muſcle *k*; which ariſing from the under jaw, and paſſing obliquely upwards behind, and in contact with, the poiſon gland, reflects itſelf forward between the two ligaments; and, after extending itſelf over almoſt the whole gland, is firmly implanted into its fore and lower part: ſerving thereby both to compreſs and contract the whole gland, and ſo to expel its fluid.

FIG. 3. gives a more diſtinct view of this gland ſurrounded by its proper muſcle.

a. SHEWS the poiſon gland.
b, and *c*. ITS two ligaments.
d. ITS duct.
e, and *f*. THE muſcle ſurrounding it, which ſerves both to cloſe the mouth in biting, or wounding

its prey, and at the ſame time to expel the poiſon.

From this view it is obvious, why a leſs accurate examination (in ſo ſmall an animal as a Viper, and whoſe muſcles, being white, are therefore leſs diſtinguiſhable from other ſubſtances) might lead inquirers into an opinion, that the whole together was a muſcle ſending off a round tendon, and ſerving to draw the fangs inward.

Fig. 4. repreſents an under view of the ſame head: in which

a. Shews the ſuperior orifice of the poiſoning fangs in their retracted ſtate.

b. Their inferior orifice.

c. Shews the fangs as covered by their bag, when in a retracted ſtate: which bag is cut open on the oppoſite ſide, in order to ſhew the fangs. And

d. A fimbriated *ſeptum* attached to the orifice of the poiſon duct, and dividing the fangs from each other.

e. SHEWS the poiſon gland, in whoſe duct two briſtles are placed, which, paſſing into the *ſacculus* at its ſummit, ſhew the entrance of the poiſon duct *f*, exactly between the ſuperior orifices of the two fangs: through which orifices the briſtles entering the fangs paſs out at their ſlits.

FIG. 2. *c.* ſhews this bag, whoſe edge is fimbriated, when ſtretched and expanded during the erected ſtate of the fangs.

FROM this appearance it has been imagined, that the poiſon being diſcharged into the bag, and the bag being gradually preſſed up to the ſummit of the fangs by the ſides of the wound, as the fangs were impelled deeper and deeper; this preſſure of the bag, acting upon its contained fluid, would be ſufficient to force and direct the poiſon through the fangs into the bottom of the wound. But the loſs of the fluid, which would partly eſcape at the gutter neceſſarily made by the contact of two cones, and (if their contact be not very cloſe) between them too, with the waſte of ſome, which would be left in the bag, have induced me to believe, that the immiſſion of the poiſon into the wound depends on circumſtances very different.

I HAVE been led to think, that, to leſſen the inconvenience of breaking the fangs, one fang only, and on one ſide only, is erected at one bite, as I have before hinted; and that, by being erected, its ſuperior orifice is brought nearly in contact with the orifice of the poiſon duct: and that, as the poiſon duct enters the bag exactly between the fangs, ſo the bag may ſerve to guide the duct to this or that ſide, according as this or that fang happens to be erected; thereby making the poiſon duct and the hollow of the fang one continued tube or canal.

In order to this we need only to ſuppoſe, that the fimbriated *ſeptum*, which divides the two fangs, is more elaſtic, or yields more eaſily, than the ſides of the bag. In this caſe the fang by its erection ſtretching the bag, the *ſeptum* being weakeſt will follow this ſtretch; and its extremity, to which the orifice of the poiſon duct is attached,

tached, be carried to this or that ſide, ſo as to meet this or that orifice, as the preſſure or erection may happen to be in this or that fang.

Fig. 5. ſhews

A. The part of the bag, which yields with the *ſeptum* to the preſſure of erection in the fang.

B, and C. The ſides of the bag, which admitting no ſtretch themſelves, may throw the whole motion on the *ſeptum* and the part A.

d, *d*. Two arches, of either of which any neceſſary part may be deſcribed by the motion of the orifice of the duct, in conſequence of the *ſeptum*'s yielding more eaſily than the ſides of the bag. The orifice of the duct thus changing its ſituation may be applied to the orifice of either of the fangs occaſionally, and the whole poiſon prepared by the gland be employed in the action of one ſingle fang: the advantages of which to the Viper itſelf have been already explained.

FIG. 4. *g*, *h*, *i*, *k*, *l*. MUSCLES ſubſervient to the motions of the jaws, whoſe actions ſufficiently appear by their ſituations and directions.

To this moſt accurate deſcription by Dr. *Nicholls*, I think it not amiſs to ſubjoin a remark, concerning the uſe of the *Rattle* at the tail of this Snake, which has its name from it: becauſe a vulgar error has obtained, even among the learned, about it.

IT is commonly ſaid, that this is a kind contrivance of divine Providence, to give warning to paſſengers,

gers, by the noiſe which this part makes when the creatures moves, to keep out of the way of its miſchief. Now this is a miſtake. It is beyond all diſpute, that wiſdom and goodneſs ſhine forth in all the works of the creation : but the contrivance here is of another kind, than is imagined.

All the parts of animals are made either for the preſervation of the individual, or for the propagation of its ſpecies: this before us is for the ſervice of the individual. This Snake lives chiefly upon ſquirrels and birds, which a reptil can never catch without the advantage of ſome management to bring them within its reach. The way is this. The Snake creeps to the foot of a tree, and by ſhaking his *Rattle*, awakens the little creatures, which are lodged in it: they are ſo frighted at the ſight of their enemy, who fixes his lively piercing eyes upon one or other of them, that they have no power to get away, but leap about from bough to bough, till they are quite tired; and at laſt falling to the ground, they are ſnapped into his mouth. This is by the people of the country called *charming* the ſquirrels and birds.

It muſt likewiſe be obſerved, that this Snake does not make any noiſe with its *Rattle* in the common motions of its body.

There is ſomething like this in the lion's hunting for his food. The hungry tyrant, by his terrible roaring in the woods, rouſes the leſſer beaſts out of their holes: they running about in fright and ſurpriſe, are eaſily ſeized, and become a prey to his devouring jaws.

And I have my ſelf ſeen, upon a hawk's ſettling upon a tree in a garden, the little birds all about it ſo ſtruck with fear, that though they could fly backwards and forwards, for ſome little diſtance, yet they have not been able to get away from the ravenous deſtroyer.

POISONOUS ANIMALS.

AS the Viper is hurtful by inſtilling a liquid Poiſon into the wound made by its teeth; ſo likewiſe all venomous creatures whatſoever, whether they bite or ſting, though there be ſome difference in the contrivance of their organs, are miſchievous after much the ſame manner: and the moſt conſiderable of them for the ſame good uſe and purpoſe, that is, in order to kill their prey.

THIS will fully appear, by examining the inſtruments of death in ſeveral of them.

FIRST then, the *Spider*, which lives upon flies, waſps, and the like inſects, is provided with a hooked *forceps*, placed juſt by the mouth, very ſharp and fine: with this he pierces the fleſh of little creatures caught in his web, and at the ſame time infuſes a juice into the puncture; by which means the animal being killed, he ſucks out the moiſture from the body, and leaves it a dry huſky carcaſe.

MR. *Van Leeuwenhoek*, in his account of Spiders, publiſhed in the Philoſophical Tranſactions (*a*), has, together with the other parts, by the help of his glaſſes, deſcribed theſe weapons; which he finds to lie couched on each ſide the

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(*a*) N°. 271.

mouth, in a row of teeth, till they are raiſed to do execution. Theſe rows of ſmall teeth are deſigned to hold the prey, that it may not eſcape the force of the bite. And in the convex part, towards the point of each claw, he has delineated a little aperture or ſlit, through which he ſuppoſes the poiſon iſſues out at the ſame time the wound is made.

THIS ſituation and motion of theſe parts I have ſeveral times viewed, but was never able to diſcern the outlet or opening; which, having a juſt deference to the induſtry and application of ſo nice an obſerver in things of this nature, I, at firſt, imputed to my own unſkilfulneſs in ſuch inquiries, knowing my microſcope to be very good: till at laſt, after repeated trials, I very plainly ſaw, that nothing dropt out of the claws, which were always dry while the ſpider bit; but that a ſhort white *proboſcis* was at the ſame time thruſt out of the mouth, which inſtilled a liquor into the wound.

THEN I concluded, that Mr. *Leeuwenhoek* had delineated the apertures in theſe weapons, only from the analogy which he thought they muſt bear to the viperine fangs, the ſting of the ſcorpion, bee, *etc.* And I was confirmed in this opinion by examining a claw of the great *American* ſpider, deſcribed by *Piſo* (*b*), and called *Nhamdu*: which being above fifty times bigger than that of the largeſt *European* ſpider, if there had been any ſlit in it, my glaſs would, no

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(*b*) Nat. Hiſt. lib. v. cap. 10.

doubt, have diſcovered it; but yet I found it to be quite ſolid.

AND indeed the quantity of liquor emitted by our common ſpiders, when they kill their prey, is viſibly ſo great, and the wounding weapons ſo minute, that they could contain but a very inconſiderable portion thereof, if it were to be diſcharged that way.

To this purpoſe, I remember Mr. *Boyle* ſomewhere tells a ſtory of a perſon blinded by a ſpider dropping its venom into his eye: which, though it can hardly find credit with ſome, is however confirmed by what *Piſo* relates of his *Nhamdu*, *viz.* that in catching it great heed is to be taken, leſt its poiſon fall into the eye, this cauſing a total loſs of the ſight.

WHAT Mr. *Leeuwenhoek* obſerves of the enmity theſe creatures bear to one another, I have often ſeen: for if four, five, or more be put together into a glaſs, they immediately fall to fighting with all the fury imaginable. Limbs ſtruck off are uſually the preludes to the terrible ſlaughter, which continues till all are killed, the ſurviving conqueror himſelf moſt commonly dying of his wounds.

THE weapons of miſchief in the *Scolopendra*, or *Centipes*, are ſomewhat different from thoſe in the ſpider. Having had one of theſe creatures ſent to me, preſerved in ſpirit of wine, from the *Eaſt Indies*, (where they are very large, and their bite is ſo painful, that, as *Bontius* ſays (*c*), it makes the pa-

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(*c*) Hiſt. nat. & med. Ind. or. lib. v. cap. 4.

tient almoſt mad) I examined the claws of its *forceps* by a microſcope; and in each of them obſerved a ſmall aperture, on the upper ſide near the point (*d*). And Mr. *Leeuwenhoek* (*e*), who had one of the ſame kind alive, found, that by preſſing the claw, a ſmall drop of liquor iſſued out of this hole.

THE caſe is much the ſame with ſtinging animals. Of theſe the *Scorpion* (*f*) is the chief, whoſe *virus* in different countries is more or leſs dangerous, according as 'tis exalted by various degrees of heat: thus in *Africa* particularly, its effects are ſo dreadful, that, as *Joan. Leo* (*g*) tells us, the town of *Peſ-*

(*d*) Vid. Tab. iii. Fig. 1 et. 2.
(*e*) Continuatio arcanor. Natur. epiſt. 124.
(*f*) Tab. iii. fig. 3.
(*g*) Hiſtor. Afric. lib. vi.

cara there, is in a manner left deſolate by the inhabitants in the ſummer time, by reaſon of the great abundance of theſe creatures; certain death following their ſting.

SEVERAL of this kind *Signor Redi* (*h*) at *Florence*, had ſent to him from *Tunis*; and, it being November, he irritated them to ſting pigeons, pullets, *etc.* without any bad effect at all: but upon the approaching ſpring, one of them, which had been kept all the winter, nay eight months, without any food, and the wound of whoſe ſting before was harmleſs, ſtung to death two pigeons ſucceſſively; but a third and fourth wounded in like manner, ſuffered no hurt. Yet having let the Scorpion reſt all

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(*h*) Generazion. degli Inſetti, pag. 15.

night, he killed another pigeon the next morning.

AT the point of the ſting he very often could diſcern a ſmall drop of white liquor, which, when the wound was made, entered into the fleſh.

AS this liquid venom is either not ſeparated from the blood into the cavity of the ſting, during the cold of winter, or at leaſt the Scorpion wants ſtrength at that time to throw it out with force and energy ; ſo even in the hot months, after it is exhauſted by two or three attacks, the ſting is no longer hurtful, till the expence of this juice is recruited by time.

VIEWING the ſting of one of theſe animals brought from the *Eaſt Indies*, (where they are much bigger than in *Africa*) I could, with a glaſs, eaſily diſcover a long ſlit, on each ſide of it, near to the *cuſpis*, which is exactly delineated by Mr. *Leeuwenhoek* (*i*), who alſo ſaw the venom drop out of it (*k*).

IT is very remarkable concerning this inſect, what an ingenious gentleman, who lived ſeveral Years in *Barbary*, told me, he had many times tried; that if it be ſurrounded with a circle of burning coals, it does, upon the ſenſe of the heat, turn it ſelf violently every way to make an eſcape; but finding it impoſſible, and the pain from the fire increaſing, it ſtrikes it ſelf twice or thrice with the ſting on the back, and immediately dies of the wounds.

(*i*) Lib. citat. epiſt. 123.
(*k*) Vid. Tab. iii. fig. 4.

THE fact has ſince been confirmed to me by others, who have aſſured me, that it is a common diverſion among the ſoldiers at *Gibraltar* (where theſe creatures abound) to make this experiment.

THIS ſelf-murther decides the controverſy among writers, whether poiſonous animals of the ſame ſpecies can kill each other. Which is not only confirmed by what we before obſerved of the ſpider, but is likewiſe true of Vipers: for Dr. *Herman* bringing from the *Indies* three of the *Cobras de Capello*, all in one glaſs, two of them were killed in the voyage by fighting. And the learned *Jo. Rhodius* at *Padua* obſerved, that two Scorpions being put into a glaſs, they fought, and one having killed the other, devoured it (*l*).

(*l*) Not. ad Scribon. Larg. Pag. 244.

As the viperine venom is the quinteſcence and moſt active part of thoſe animal juices, with which the Viper is nouriſhed; ſo is alſo that of the Scorpion: for this inſect lives chiefly upon locuſts, *etc.* and the ſame perſon from *Barbary* informed me, that ſeeing oftentimes locuſts ſticking up in the ground, as if they were ſet there, by looking he found that ſome part of them was always eat away; and that theſe places were the holes of Scorpions, who had dragged their prey thither, and fed on it as they had occaſion.

THE mechaniſm of the ſting of a *Bee* Dr. *Hooke* has very accurately deſcribed (*m*). One may with the naked eye ſometimes ſee it diſcharge the venom; and in

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(*m*) Micrograph. Obſerv. 34.

this, by the help of a glaſs, I can eaſily diſcover a great number of minute ſalts floating.

AND indeed this *apparatus* or contrivance is ſo univerſal, that we find even in vegetables ſomething analogous hereunto : for the laſt mentioned author (*n*) has ſhewn us, that the pricking points of Nettles do, at the ſame time they pierce the ſkin, inſtil a venomous juice into the wound.

As the bites and ſtings, not only of theſe inſects we have mentioned, but alſo of ſeveral others, as hornets, waſps, gnats, *etc.* are often very troubleſome, and attended with more pain, inflammation and ſwelling, than would be expected from ſuch little enemies ;

(*n*) Micrograph. Obſ. 25.

I ſhall conclude with obſerving, that the common cure in all accidents of this kind, will be, (as in the bite of a Viper) by immediately ſucking out with the mouth the inſtilled poiſonous drop, and applying to the wound a pultice of bread and milk: but if this has been neglected, the part muſt be fomented with warm oil and ſoft diſcutient ointments.

ESSAY II.

Of the TARANTULA.

THE Symptoms from the bite of the *Tarantula* are ſo very odd and ſurpriſing, that the truth of the facts has by ſome been called in queſtion. There is reaſon for this ſuſpicion, becauſe the miſchief commonly happens to poor people; who, as they often receive charity upon it, may be tempted to diſſemble, and to act a part, as if they ſuffered what they really have not. And beſides this, hyſterical affections (as we ſhall obſerve

ſerve by and by) are in this country ſometimes attended with the ſame appearances: ſo that it is hard to diſtinguiſh one caſe from the other.

HOWEVER, though there are here many deceits and impoſtures, yet even theſe, I think, are an evidence to prove the point: ſince it cannot be ſuppoſed, that a diſeaſe would be counterfeited, which had never any foundation in nature.

NEITHER can I be perſuaded, that *Baglivi*, a native of the country, and a learned phyſician, (who muſt have known that tricks were played in this way) would have taken the pains to write a long diſſertation on this ſubject (*a*), had he not been thoroughly

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(*a*) Vid. Baglivi de Praxi Medica, et Diſſertationes, Romæ, 1696.

roughly convinced of the reality of ſuch a poiſon.

BESIDES this, after *Baglivi's* book was publiſhed, *Ludovicus Valetta*, a *Celeſtine* monk of *Apulia*, put out at *Naples* a treatiſe upon this Spider (*b*); in which he not only anſwers the objections of thoſe, who deny the whole thing, but gives from his own knowledge ſeveral inſtances of perſons, who had ſuffered this way: ſome of whom were of great families, and ſo far from being diſſemblers, that they would at any rate, to avoid ſhame, have concealed the misfortune, which had befallen them.

To theſe may be added the teſtimony of the Hon. Mr. *Boyle*,

(*b*) De Phalangio Apulo opuſculum, Neapoli, 1706.

who aſſures us, that having himſelf had ſome doubts about this matter, he was, after ſtrict inquiry, convinced that the relations in the main were true (*c*).

I SHALL therefore, from the authentic accounts given by the two mentioned authors, extract what is moſt material and neceſſary to our preſent purpoſe.

THE *Tarantula* (*d*) is a *Spider* of *Apulia*, of the octonocular kind; that is, of that ſpecies that has eight eyes, and ſpins webs. It has eight legs, four on each ſide, and in each leg three joints. From the mouth proceed two darts, in ſhape juſt like to a hooked *forceps*, or

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(*c*) Of languid and unheeded motions, chap. vi.

(*d*) Tab. iii. fig. 5.

crab's claws: theſe are ſolid, and very ſharp, ſo that they can eaſily pierce the ſkin. And between theſe and the fore-legs there are two little horns, which I ſuppoſe anſwer to thoſe bodies called from their uſe in flies the Feelers: becauſe as they do, ſo this creature is obſerved to move them very briſkly, when it approaches to its prey.

THIS, as other Spiders do, propagates its ſpecies by laying eggs, which are very numerous; ſo that there are found ſometimes in the female, when diſſected, a hundred or more: and theſe are hatched partly by the heat of the mother, partly by that of the ſun, in about twenty or thirty days time.

THERE is alſo a Spider of the like nature with the *Tarantula* in the *Weſt-Indies*, which *Fr. Hermandez* (*e*) deſcribes by the name of *Hoitztocatl*, or the *pricking Spider*; and ſays, that its bite induces madneſs.

IN the ſummer months, eſpecially when the heats are greateſt, as in the Dog-days, the *Tarantula* creeping among the corn in the fields, bites the mowers and paſſengers: in the winter it lurks in holes, and is ſcarcely ſeen; and if it does bite then, it is not venomous, neither does it induce any ill ſymptoms.

BUT in the hot weather, although the pain of its bite is at firſt no greater, than what is cauſed by the ſting of a Bee; yet the part

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(*e*) Hiſtor. Animal. Nov. Hiſpan. Tract. iv. cap. 5.

quickly after is diſcoloured with a livid, black, or yellowiſh circle, and raiſed to an inflamed ſwelling. The patient within a few hours is ſeized with a violent ſickneſs, difficulty of breathing, univerſal faintneſs, and ſometimes trembling, with a weakneſs of the head: being aſked what the ail is, he makes no reply, or with a querulous voice, and melancholy look, points to his breaſt, as if the heart was moſt affected.

DURING this mournful ſcene, all the uſual *alexipharmac* and *cordial* medicines are of no ſervice: for notwithſtanding their repeated uſe, the patient growing by degrees more melancholy, ſtupid, and ſtrangely timorous, in a ſhort time expires; unleſs *Muſic* be called to his aſſiſtance, which alone, without the help of medicine, performs the cure.

FOR at the firſt ſound of the muſical inſtrument, although the ſick lie, as it were, in an apoplectic fit, they begin by degrees to move their hands and feet; till at laſt they get up, and fall to dancing with wonderful vigour, at firſt for three or four hours: then they are put to bed, refreſhed from their ſweating, for a ſhort time, and repeat the exerciſe with the ſame vehemence; perceiving no wearineſs or weakneſs from it, but profeſſing they grow ſtronger and nimbler, the more they dance.

AT this ſport they uſually ſpend twelve hours a day, and it continues three or four days; by which time they are generally freed from all their ſymptoms, which nevertheleſs attack them again about the ſame time the next year: and if they do not take care to prevent this relapſe by muſic, they fall into a jaundice, want of appetite, univerſal weakneſs, and ſuch like diſeaſes; which are every year increaſed, if dancing be neglected, till at laſt they prove incurable.

As muſic is the common cure, ſo they, who are bitten, are pleaſed, ſome with one ſort of it, ſome with another. One is raiſed with a pipe, another with a timbrel; one with a harp, another with a fiddle; ſo that the muſicians make ſometimes ſeveral eſſays, before they can accommodate their art to the venom: but this is conſtant and certain, notwithſtanding this variety, that they all require the quickeſt and briſkeſt tunes, and are never moved by a ſlow, dull harmony.

WHILE the *Tarantati*, or affected, are dancing, they loſe in a manner the uſe of all their ſenſes, like ſo many drunkards, do many ridiculous and fooliſh tricks, talk and act obſcenely and rudely; take great pleaſure in playing with vine leaves, with naked ſwords, red cloths, and the like; and on the other hand can't bear the ſight of any thing black: ſo that if any by-ſtander happen to appear in that colour, he muſt immediately withdraw, otherwiſe they relapſe into their ſymptoms with as much violence as ever.

IT may afford ſome light towards underſtanding the nature of this poiſon, to obſerve that *Apulia* is the hotteſt part of all *Italy*, lying eaſtward, and having all the ſummer long but very little rain to temper the heats: ſo that the inhabitants breath an air, as it were, out of a firey furnace. Hence their temperament is dry and aduſt, as appears by their being generally lean, paſſionate, impatient, ready to action, quick-witted, very ſubject to inflammatory diſtempers, phrenſies, melancholy, and the like: upon which account there are more mad people in this, than in all the other parts of *Italy*. Nay, what in other countries is but a light melancholy, ariſes here to a great highth: for women in a *Chloroſis* ſuffer almoſt the ſame ſymptoms as perſons poiſoned by the *Tarantula* do, and are cured the ſame way; and in like manner the venom of the ſcorpion does here in its effects and cure agree very much with that of this ſpider.

FROM all this hiſtory it ſufficiently appears, that thoſe that are bitten by a *Tarantula*, do thereupon become delirious. In order therefore to account for the ſymptoms they ſuffer, it may not be improper to ſay ſomething concerning a *Delirium*.

SUCH is the conſtitution of the human oeconomy, that as upon the impreſſion of outward objects made upon the organs, and by the fluid of the nerves conveyed to the common ſenſory, different *ſpecies* are excited there, and repreſented to the mind; ſo likewiſe upon this repreſentation, at the command of the mind, part of the ſame fluid is determined into the muſcles, and, together with the arterial blood there, performs all the variety of voluntary motions and actions.

THIS order has been always ſo conſtant in us, that at length by a kind of natural habitude, without the intervention of the reaſoning faculty, repreſentations made to the mind immediately and neceſſarily produce ſuitable motions in the bodily organs. When therefore theſe repreſentations are irregular, the actions conſequent to them muſt neceſſarily be ſo too.

THIS being premiſed, it may perhaps be probably ſaid, that a *Delirium* is the repreſentation and various compoſition of ſeveral *ſpecies* to the mind, without any order or coherence; together, at leaſt moſt commonly, with irregular, or, as it were, undeſigned motions of the body: that is, ſuch a wandering and irregular motion of the nervous fluid, whereby ſeveral objects are repreſented to the mind, and upon this repreſentation divers operations performed by the body; though thoſe objects are not impreſſed upon the organs, nor thoſe operations or motions deliberately commanded by the ſoul.

THE mind indeed is the firſt principle of all muſcular motion: but in ſuch caſes as theſe, its promptitude to action or habit being ſo great, it is in a manner ſurpriſed, and cannot recover it ſelf, after the ſpirits are with violent force determined purſuant to the repreſentation of the *ſpecies*. For, as in the former ſtate of things, a man is ſaid to act rationally, ſo this latter caſe is called a perturbation of mind, that is, a *delirium*; though it is very manifeſt, that in reality the defect is not in the rational, but corporeal part: ſuch *ſpecies* being really preſented to the mind, upon which by the order of our conſtitution ſuch motions ought to follow in the body.

THUS, for inſtance, if the liquor of the nerves is, without the preſence of any thing hurtful, put into a motion like unto that, which a painful impreſſion makes in it; the ſame bodily actions muſt enſue, as proceed from fear, anger, or the like paſſion, determining the ſpirits towards the muſcular parts. And a by-ſtander, who ſees no reaſon for ſuch a repreſentation made to the mind, will preſently conclude, that the perſon thus acting acts without or beſide his reaſon, that is, is delirious; eſpecially if the hurry and confuſion of the ſpirits be ſuch, that not only one, but ſeveral different *ſpecies* be at the ſame time preſented to the mind: for a man in this caſe may act the part one joyful, angry, timorous, or the like, without any appearing reaſon, and all this almoſt in the ſame moment of time.

IN one word, *Deliria* are the dreams of thoſe who are awake. And as theſe in us ſleeping are infinitely various and wonderfully compounded, and all from the ſame common cauſe, diverſely preſſing the orifices of the nerves, and thus making different repercuſſions of their fluid; and as we all know that, in this confuſion of repreſentations to the mind, there hereupon follow (though the body ſeem now in prefect repoſe) ſuch motions in the organs, as are uſually the effect of the arbitrary determination of the ſpirits thither: ſo we are now to inquire,

quire, what alteration of the body, made by this venom, can be the occaſion of this diſorder and tumult in the nervous fluid, which excites in the party infected ſuch ſurpriſing, and almoſt contradictory repreſentations.

MOST of the ſymptoms of thoſe, who are bitten by the *Tarantula*, are at the firſt, that is, before they riſe to a *delirium*, plainly the ſame with thoſe which the bite of a viper induces: without doubt therefore, as we have before obſerved of the common ſpider, that it pierces the fleſh with its hooked *forceps*, and at the ſame time inſtils from the *proboſcis* in the mouth a liquid venom into the wound; ſo the like claws in this (*f*) ſerve to make way for an active

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(*f*) Vid. Tab. iii. fig. 5.

and penetrating juice emitted from the ſame part.

THIS firey drop (as in the caſe of other poiſonous animals) puts the nervous liquor into a ferment: a fever enſues: the ſecretion of this fluid in the brain, and conſequently its derivation into the organs, is irregular: the impreſſions of outward objects upon the ſpirits ſo inflamed affect too ſenſibly; nay, without the action of theſe, in ſuch a diſturbed ſtate of the oeconomy, ſpecies or images are preſented to the mind, which produce ſuitable, that is, irregular motions in the body.

MORE will be ſaid to this purpoſe in the following Eſſay. For the preſent it may ſuffice to obſerve, that theſe repreſentations and actions will generally be according to the temperament of the patient; and the ſpirits will be hurried to thoſe parts, to which in time of health they have been moſt frequently determined: and every one knows which theſe are in hot countries and conſtitutions.

IT will perhaps make this theory probable, to conſider that *Baglivi* (*g*), in the diſſection of a rabbit, killed by a *Tarantula*, found the ſubſtance of the brain, near the origin of the nerves, lightly inflamed, with livid ſpots here and there; a large quantity of extravaſated *ſerum* upon the brain: the effect generally of the circulation of the blood ſtopped by a fault in the ſecretion of the nervous liquor.

(*g*) Pag. 40.

As to the cure, which ſeems almoſt ridiculous, we muſt take notice, that the patients have no inclination to dance, till they hear the muſic: being deſired to do it, they anſwer, it is impoſſible, they have no ſtrength. Their ſtarting up therefore, at the firſt noiſe of the inſtrument, is of a piece with their other actions: for as every thing from without has too great an effect on the nerves and their diſordered fluid; ſo ſounds, which formerly were joined to this exerciſe, and encouraged it, now excite to it with fury and violence. And the benefit of it is, that the continued motions of the limbs produce large ſweats, which, by carrying off the inflammatory particles, abate the fever raiſed in the animal ſpirits.

BUT beſides this, we may perhaps allow ſomewhat to the determinate force and particular modulation of the trembling percuſſions of the air, made by the muſical chords upon the elaſtic fibres in the brain: for contractil bodies may be acted upon by one certain degree of motion in the ambient fluid, though a greater degree of it, differently modified, may produce nothing of the like effect. This we ſee in the common experiment of two muſical inſtruments, tuned both to the ſame pitch: the ſtrings of the one being ſtruck, the correſpondent ſtrings of the other will ſound; and yet a much greater motion of the air, otherwiſe agitated, will not cauſe any ſenſible vibration in the ſame chords. And alſo by a trick which ſome have, of finding the tone or note peculiarly belonging to any large wine-glaſs, and by adapting their voice exactly to that tone, and making it loud and laſting, they will make the veſſel, firſt to tremble, and then burſt: which it will not do, if their voice be but a little either too low or too high (*h*).

MR. *Boyle* relates a ſtory, from *Scaliger*, of a knight of *Gaſcony*, whom the ſound of a bag-pipe would unavoidably force to make water; though this ſecretion is regularly made by the arbitrary contraction of the muſcle of the bladder (*i*).

THIS makes it no difficult matter to conceive the reaſon, why

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(*h*) Vid. Morhofii Stentor ΥΑΛΟΚΛΑΣΤΗΣ. Kilon. 1682.

(*i*) Of languid and unheeded motions, chap. vi.

different perſons infected with this venom, require often for their cure a different kind of muſic: their fibres having different tenſions, are not in like manner acted upon by the ſame vibrations.

THE obſtinate continuing of the patients in this exerciſe is, in a great meaſure, owing to the encouragement of the by-ſtanders, and the ſtrong opinion they have of being benefited by it.

NOR are we to wonder at this practice, as odd and irrational: for *Muſic* was anciently very much made uſe of to medicinal purpoſes; and may without doubt do very great ſervice, even by a mechanical force, in many bad diſtempers; particularly in ſome diſorders of the mind, which being always attended with irregular hurries of the ſpirits, may be quieted by exciting in them ſuch motions, as accompany the contrary paſſions.

IT is plain from the hiſtory of king *Saul*, that this was known in very early days among the *Jews*. He being at times ſeized with fits of madneſs, was cured this way (*k*): for the *evil ſpirit from the Lord*, I ſuppoſe (according to the *Jewiſh* manner of expreſſing extraordinary incidents) means no more than a *maniacal fury*, which by divine judgment he at certain times fell into.

WE have a famous teſtimony to this purpoſe in *Galen* (*l*), who

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(*k*) 1 Samuel, chap. xvi.
(*l*) De Sanit. tuenda, lib 1. cap. viii.

tells us, “ that *Aeſculapius* uſed to “ recover thoſe, in whom violent “ motions of the mind had induced a hot temperament of “ body, by melody and ſongs.” *Pindar (m)* mentions the ſame thing: and indeed from hence not only the notion, but the very name of *charming (n)* ſeems to have taken its origin.

THUS *Athenaeus* relates, that *Theophraſtus* in his book of *Enthuſiaſm* ſays: “ Iſchiadic pains “ are cured, if any one ſooth (or “ *charm*) the part by *Phrygian* “ harmony” (*o*). And in the like alluſive ſenſe *Caelius Aurelianus*

(*m*) Pythior. Od. 3. μαλακαῖς ἐπαοιδαῖς. Vid. ibid. Scholia.

(*n*) A carmine.

(*o*) Deipnoſoph. l. xiv. p. 624. Ἰσχιακοὺς φάσκων ἀνόσους διατελεῖν, ἐι καταυλήσοι τὶς τοῦ τόπου τῇ Φρυγιστὶ ἁρμονία.

calls this practice, *decantare loca dolentia*; and then adds by way of explication, that "the pain is mitigated and diſcuſſed by the "tremblings and palpitations of "the part *(p)*". Which ſeems very well to agree with what was before remarked, concerning the mechanical force of muſic upon the elaſtic fibres of the brain, whereby the ſpirits being determined to the parts affected excite thoſe motions in them, which produce a cure. Beſides, as *Athenaeus* here intimates, the *Phrygian* muſic was upon a pipe, which was the moſt vehement and briſk of all the ancients knew; ſo that indeed it was ſaid to raiſe thoſe, who heard it, to perfect fury and madneſs *(q)*: and ſuch

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(*p*) Morb. chronic. l. v. c. 1. Quae cum ſaltum ſumerent palpitando, diſcuſſo dolore, miteſcerent.

(*q*) Vid. Bartholin. De tibiis veter. l. 1. c. 9.

we have obſerved to be requiſite for the venom of the *Tarantula.*

Aulus Gellius (*r*) not only relates this ſame cure of *Iſchiadic* ails as a thing notorious enough; but adds beſides out of *Theophraſtus,* "that "the muſic of a pipe rightly managed healed the bites of Vipers."

AND not only does *Apollonius* (*s*) mention the cure of diſtractions of the mind, epilepſies, and ſeveral other diſtempers this ſame way; but *Democritus* (*t*) in his treatiſe of Plagues taught, "that "the muſic of pipes was the medicine for many diſeaſes; "which

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(*r*) Noct. Atticar. l. iv. c. 13.

(*s*) Hiſtor. Mirabil.

(*t*) Apud Aul. Gell. loc. citat. Plurimis hominum morbis medicinam fuiſſe incentiones tibiarum.

Thales of *Crete* confirmed by his practice: for when ſent for by the *Lacedaemonians* to remove from them the peſtilence, he did it by the help of muſic (*u*).

ALL which inſtances evince this remedy to have been very ancient in many caſes. And indeed as *Caelius Aurelianus* (*x*) takes notice, that the firſt uſe of it was aſcribed to *Pythagoras* himſelf, ſo he having ſettled and founded his ſect in thoſe very parts of *Italy*, which are the country of the *Tarantula*, going then under the name of *Graecia magna*, now *Calabria*; it is not, I think, at all improbable, that he might have been the author and inventor of this practice there, which has continued ever ſince:

(*u*) Plutarc. de Muſica.
(*x*) Loc. ante cit.

eſpecially ſince *Jamblichus* affirms *(y)*, not only that he made uſe of muſic in phyſic, but particularly that he found out and contrived ſome harmonies to eaſe the paſſions of the mind, and others for the cure of bites.

To this uſeful power of Muſic I will (to confirm my reaſonings upon it) add a remarkable inſtance of its hurtful effects, even in a brute; which an ingenious gentleman told me, he once ſaw. A player on a fiddle having frequently obſerved, that a dog in the room was always ſo affected by a particular note, as to howl, and ſhew great uneaſineſs at it; one day, for experiment's ſake, continued to ſtrike the ſame note ſo long, till the ſenſible animal fell into convulſions and died.

(y) De Vit. Pythagor. cap. 25. πρὸς δηγμοὺς βοηθητικώτατα μέλη.

To conclude with the *Tarantula*, we may take notice, that, as to the return of the ſymptoms the next year, that is owing to the ſame exceſſive heat in thoſe months, acting again upon the ſmall remains of the venomous ferment. Thus *Bartholin* (z) relates a ſtory of a melancholy phyſician at *Venice*, who ſuffered the attacks of his diſeaſe only during the dog-days, which yearly ended and returned with them: a convincing proof how great a ſhare heat has in all theſe caſes.

(z) Hiſtor. Anatom. Cent. 2. H. 16.

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ESSAY III.

Of the MAD DOG.

THE terrible effects of the *Poiſon* from the bite of a *Mad Dog* appear after ſo different a manner in different ſubjects, that the accounts given of them by authors, being generally taken from ſingle caſes, are very different, and hardly conſiſtent with one another. The main ſymptom indeed they all agree in, that is, what they call (though improperly) the *Hydrophobia*, or *Dread of Water*: but the diſorders, with which this is attended, are related ſo variouſly, that they can ſcarcely be thought to belong to the ſame kind of malady.

I SHALL therefore firſt deſcribe the hiſtory of this diſeaſe, from obſervations made on a conſiderable number of patients; and then inquire into the reaſons, why the fatal diſtemper commonly produced by it ſhews it ſelf with ſo much variety, and appears, as it were, diſguiſed in ſome caſes.

THE wound from the bite of a mad dog differs not at all from that made by a common bite, and is as eaſily healed: and it is uſually a conſiderable time before any bad conſequences of it appear. There are inſtances where theſe have been deferred to three, four, or ſix months; nay, ſome authors ſay, to a year and longer. *Galen* himſelf ſaw one caſe after a year (*a*); I remember one after eleven months: but the attack is generally within thirty or forty days, though very often ſooner, ſometimes in fifteen or ſixteen days, in young ſubjects.

THE firſt approaches of the diſtemper generally diſcover themſelves after this manner. A pain is felt in the part which was wounded, which by degrees ſpreads it ſelf to the neighbouring parts: a laſſitude follows with uneaſineſs in all the limbs. Then the patient grows penſive and ſad, with diſturbed and unquiet ſleeps, complains of faintneſs and lowneſs of ſpirits, particularly of an oppreſſion at his breaſt. His pulſe

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(*a*) Comment. ii. in I Prorrhet. Hippocrat.

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intermits, his nerves tremble, he has cold ſweats, a great *nauſea* and ſickneſs at ſtomach, and loaths food: and though he has an inward heat and thirſt, and deſires to drink; yet he ſwallows meat, but eſpecially liquors, with great difficulty. Theſe ſymptoms increaſe, and the next day, from the great uneaſineſs and pain, which he finds in ſwallowing, he conceives ſuch an averſion to liquids, that at the firſt ſight of them he falls into convulſions and agonies, and cannot get down the leaſt drop. This *Hydrophobia* has always been accounted the ſureſt ſign and mark of this poiſon, by which it is diſtinguiſhed from all other diſeaſes; as not being obſerved, at leaſt very rarely, in any other caſe whatſoever.

AT this time a fever uſually appears, with a quick but low pulſe, without the leaſt ſleep, a hoarſe voice, a gathering of froth in the mouth, and ſpitting out of this upon the by-ſtanders; univerſal convulſions, particularly about the throat, and in the *muſculi erectores penis*, whence a continued *priapiſm* is obſerved. During this tragical ſcene, which always proves fatal in about two days, a *delirium* comes on, ſometimes with moſt terrible ſymptoms of rage and fury, and attempts of doing all poſſible miſchief even to the moſt beloved friends and relations; but more commonly without any *furor*, it is of the *melancholy* kind, and the wretch reſigns to death, and prepares for it, bids thoſe about him take care of themſelves, leſt he ſhould do them a miſchief; and begs that they would trouble him no more: and, his breath growing ſhorter and ſhorter, he expires in convulſive fits.

MANY of the ancients have mentioned this diſeaſe, particularly *Dioſcorides*, *Galen*, *Aetius*, *Aegineta*; but none have deſcribed it ſo largely as *Caelius Aurelianus* (*b*), who, from the writings of the *Greek* phyſicians, (chiefly *Soranus*, of the methodic ſect) has collected, and put into obſcure bad *Latin*, all the ſymptoms of it, with great pains and exactneſs. The names of the more modern authors on this ſubject may be ſeen collected by that diligent obſerver, *Stalpart Vander Wiel* (*c*), to which may be added the learned Dr. *Liſter* (*d*).

(*b*) De morbis acutis, lib. iii.

(*c*) Obſervat. rarior. Cent. i. Obſ. 100.

(*d*) Exercit. Medicinal.

IT will afford great light towards the knowledge of the nature of this abſtruſe diſeaſe, to remark ſome odd appearances in the progreſs of it: which, though with a little variety, diſcover themſelves in a greater or leſſer degree in all the unhappy patients.

IT is common to them all, that they can ill bear the impreſſion of objects upon the ſenſes. All feeling is painful. The ſlighteſt touch or rubbing of the limbs hurts. The leaſt noiſe is offenſive: and the opening or ſhutting of a door affrights, as if the houſe was falling. The eyes ſo ill bear the light, that even the ſight of any thing white is intolerable. In like manner, the inward membranes are ſo tender, that they cannot ſuffer their natural ſenſation. The common coolneſs of freſh air is diſagreeable to the lungs: and the making of water gives uneaſineſs and grief in the urinary paſſages. The aſpect is diſmal, either frightful with tokens of rage and fury, or lamentable with marks of moaning and deſpair. There is no ſleep from the begining of the fever to the end.

WHEN the ſymptoms are *maniacal*, the ſtrength of the muſcles is prodigious: theſe acting indeed with a convulſive force ſo great, that I have ſeen a caſe, in which a man tied down in bed with ſtrong cords broke them all at once by one effort, and immediately died paralytic; as if all the fibres of the body had been overſtrained, and torn to pieces by their violent action.

As to the *Hydrophobia*, the patient at firſt has no dread of water, nor any averſion to liquors. On the contrary, he ſees them with pleaſure: being thirſty he deſires drink; but then ſoon wonders, what ſhould be the reaſon, that he is not able to take it. He contrives ways to do it, by endeavouring to ſuck through a quill, *etc.* but ſoon cries out: It is impoſſible. When aſked why, he anſwers: It will not go down, it ſtrangles him, and begs to be excuſed trying any more.

IN order to find out the cauſe of this train of dreadful events, we muſt take notice, that the *rabies* or madneſs in a dog is the effect of a violent fever; and therefore it is moſt common in exceſſive hot weather, though ſometimes intenſe cold may be the cauſe of it: that no dog ever ſweats; from whence it follows, that when his blood is in a ferment, it cannot, as in other creatures, diſcharge itſelf upon the ſurface of the body; and therefore muſt of neceſſity throw out a great many ſaline and active particles upon thoſe parts, where there is the moſt conſtant and eaſy ſecretion: and ſuch, next to the *miliary* in the ſkin in us, are the *ſalival* glands. For this reaſon much more ſpittle is ſeparated in a dog, when mad, than at any other time, and that very frothy, or impregnated with hot ſubtile parts.

THE looks of a dog in this condition diſcover a fever. He runs wildly forward panting, ſnaps at every one he meets: his tongue hangs out of his mouth with ſlabber: his eyes are heavy, full of tears: he takes no food nor drink. In diſſecting one, who died mad, the forepart of the *dura mater* on the brain, about an inch above the eye-brows, was found inflamed and even ulcerated, the ulcerations piercing through this membrane, and alſo the *pia mater*: and upon preſſure there iſſued out from the ſmall ulcers a thin matter tinged with blood.

Now as we every day obſerve, that what is thrown out from liquors in a ferment, is capable of inducing the like motion in another liquor of the ſame kind, when duly mixed with it; ſo we may very well ſuppoſe in the preſent caſe, that the *ſaliva*, which is itſelf one of the moſt fermentative juices in nature, being turgid with firey ſaline particles thrown into it out of the boiling blood, when it comes by means of a wound to be mixed with the nervous liquor in another animal, muſt neceſſarily put it into violent agitations, in the nature of a ferment, (as has been explained in the Introduction:) the conſequence of which will be all the effects of an interrupted ſecretion in the brain, and diſturbed circulation of the blood, a fever with a *delirium*, convulſions, *etc.*

THAT this *delirium* is ſometimes *maniacal*, ſometimes *melancholic*, is owing to the different temperament and conſtitution of the patient, inclined more to paſſions of one kind or the other. As we ſee the effects of drunkenneſs are in one man good humour, mirth, and joy; in another, ill-nature, malice, and rage; in a third, a mixture of ridiculous and extravagant actions: and all from the ſame common cauſe, raiſing natural diſpoſitions to a higher pitch. And we muſt likewiſe obſerve, that the huntſmen diſtinguiſh in dogs themſelves two kinds of this diſeaſe, one of which they call the biting, the other, the ſullen madneſs.

IN ſhort, this diſtemper is a fever of that kind, in which the nervous fluid is more particularly affected, from the violent action of an extraneous firey matter mixed with it. A *delirium* enſues, attended, according to the diſpoſition of the body, with ſymptoms either of fury or of deſpondency, and very often with a mixture of both. For we know that theſe are frequently changed, and ſucceed to each other: a *mania* being indeed uſually a hightened melancholy; that is, from great and continued lowneſs of ſpirits, apprehenſions of evil increaſe more and more, and the imagination is poſſeſſed with *ſpecies* of things moſt terrible and deſtructive: upon which the mind is neceſſarily determined to actions, which by the conſtant order of nature follow upon ſuch repreſentations. And we therefore find, that, even in common fevers, patients will ſometimes give warning of their growing furious: that is, of their preception of frightful images, which will of courſe unavoidably hurry the mind to outragious efforts.

BUT the *Hydrophobia* (though it is commonly thought to be ſo) is no part of this *delirium:* as will appear anon.

FROM the deſcription we have given, it may, I think, be concludcluded, that there is in all theſe caſes ſome degree of inflammation, with too great a tenſion and drineſs of the nervous membranes, and too much elaſticity and force in the fluid, with which they are filled: that by this they have acquired a preternatural ſenſibility; ſo that the uſual impreſſions of outward objects, inſtead of an agreeable feeling, give pain and uneaſineſs; and inward images are ſo ſtrong and lively, that the mind is ſurpriſed, and determines the ſpirits into the muſcular organs with an irregular *impetus*.

As a proof of this, the diſſection of the dead bodies generally diſcover the veſſels in the brain diſtended, the *ſinus longitudinalis* full of fluid blood, not coagulated, as is uſual in moſt other diſeaſes of the head: the brain it ſelf, and the *ſpinal marrow*, drier than ordinary: the *pericardium* without liquor: the *lungs* loaded: the *arteries* full of blood, very fluid and hardly concreſcible in the open air: appearances all, which ſhew the animal ſpirits to have been principally affected.

THE *Hydrophobia*, we ſaid, is no part of the *delirium*. For the patients, being feveriſh and thirſty, do always deſire drink, as long as they can ſwallow it: at laſt they find they can neither eat nor drink, but drinking is the moſt difficult. Now the reaſon is this. This fever is of the *nervous* or *ſpaſmodic* kind: all the nerves are drawn into cramps; particularly the muſcles employed in deglutition are convulſed, their action is loſt, and it is then impoſſible to get any thing down. To aſk one in this condition to drink, is to deſire him to choak himſelf: and when he has found this to be ſo, he dreads the ſight of liquors offered to him, as much as he would a knife preſented to his throat, and ſtrives to keep them from his mouth. Liquids in ſuch a ſtate are ſwallowed with more difficulty than ſolids: becauſe the inſtruments of *deglutition* (which are principally, the back part of the *tongue*, the hinder part of the *palate*, and the upper part of the *oeſophagus*) can more effectually embrace and act with their joint force upon ſolid, than upon liquid ſubſtances. And beſides this, the *epiglottis* (which muſt always be cloſely ſhut at this time) is more powerfully preſſed down by a ſolid, than by a liquid body. When therefore the united force of theſe parts is taken away by convulſions, ſome part of the liquids will ſlide down into the *aſpera arteria*: upon which a ſuffocation muſt immediately follow. This diſeaſe therefore ſhould have been called Δυσκατάποσις, a difficulty in ſwallowing; rather than Ὑδροφοβία, a dread of water.

IT will ſerve both to illuſtrate and confirm this reaſoning, to take noitce, that there are other diſtempers beſides this, (and all indeed of the nervous kind) in which the ſame frightful ſymptom is ſometimes obſerved. Authors (*e*) have remarked it in malignant fevers: and a common melancholy has been ſeen to end fatally in it (*f*). I have known it, in the highth of a violent *hyſteric* diſor-

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(*e*) Schenckius de Venen. Animal. Salmuth. Obſerv. Cent. ii. Obſ. 52.

(*f*) Ephemer. German. ann. 1687.

der, to have continued for many hours, till the convulſive motions in the throat were quieted by proper medicines: and I remember a caſe, in which fits of a palpitation of the heart were attended with ſo great a degree of it, that it ſeemed not to differ from the true *Hydrophobia.*

ON the other hand, it has ſometimes happened, that this bite has been followed with all the other uſual ſymptoms, even to a fatal degree, and yet no *Hydrophobia* has appeared. A learned phyſician aſſured me, that in *Shropſhire* he ſaw three patients in one year, who, at the ordinary time of about thirty or forty days after the wound, all fell into ſuch nervous diſorders as have been deſcribed, a fever, *delirium*, oppreſſion of the breath, palpitation of the heart, ſpaſms, *etc.* and died on the third day: yet none of them, during this melancholy ſcene, had any difficulty of ſwallowing, or ſhewed any ſigns of a dread of liquids.

The *Hydrophobia* therefore is only a local convulſion, which, when the univerſal feveriſh affection of the nervous ſyſtem is come to the highth, is very ſeldom abſent: but though it be, the ſpaſms of all the other parts may prove mortal. And becauſe this fever of the ſpirits is rarely ſo violent in any caſes, except the bite of a mad dog, as to produce a difficulty of ſwallowing; this ſymptom has been thought to be peculiar to that poiſon.

NOTHING ſeems more wonderful in this whole affair, than that the venom ſhould as it were lye latent in the body ſo long a time, before it diſcovers itſelf. Now if, as has been ſaid, the poiſonous *ſaliva* acts upon the nervous fluid in the manner of a ferment, it may well be conceived, that before this can have a ſenſible effect, it muſt make ſome alteration in the more ſolid fibres of the brain, by inducing perhaps that tenſion and drineſs of the membranes, which we have mentioned. This in different conſtitutions will be done in a different ſpace of time: nay it may ſo happen, that this ferment being weak, and the conſtitution ſtrong, no viſible miſchief may enſue, till ſome accidental alteration in the body unluckily gives it an additional force: as we obſerved in the caſe of the *Tarantula*, how far external heat promotes the *delirium*.

AND therefore, by parity of reaſon, the calamitous ſymptoms may ſometimes, by the concurrence of extraordinary circumſtances, be unexpectedly brought on in leſs time than any above mentioned.

WE experience every day in common nervous diſtempers, that the return and violence of the fits depend very much upon the action of things both within and without. We may add to this, that in ſome diſeaſes, in which the blood it ſelf is infected, and the ſolid parts, even the bones, corrupted, the poiſon ſeems to be hid a conſiderable time, while it is working in the body, before its laſt effect appears: as particularly in venereal caſes.

NEITHER will it ſeem ſtrange, that a poiſon ſo different in its force, and ſo alterable by many circumſtances, ſhould in ſome ſubjects produce ſymptoms of the ſame convulſive kind, yet not to ſuch a degree as to hinder *deglutition*: and theſe too only at particular times.

A ſoldier of a ſtrong habit of body came to me not long ſince, who once a month was ſeized with a great anxiety, palpitation of the heart, and difficulty of breathing. He had been bitten by a mad dog about ſix weeks before he began to complain. By bleeding, cold bathing, the powder of *Lichen* with pepper, and volatil medicines during the oppreſſion, the fits were every month leſs violent, and at laſt quite left him.

A MOST remarkable caſe of this kind was communicated to me by a perſon of unqueſtioned veracity. It was this. A gentlewoman in *Yorkſhire*, of the age of thirty-five years, was bit by a mad dog in the fore-finger: about a month after, ſhe had a pain in that part, which ſhot up to the ſhoulder, and was thought to be rheumatic. This pain returned every month, juſt a day before the full moon, laſting generally three days. After fifteen months ſhe fell into the *Hydrophobia*, and died the third day. Her friends then recollected the bite to have happened ſo long before.

THE influence of the moon in theſe caſes I am convinced is of ſome weight. The manner of its action I have attempted to explain

plain in another place (*g*): and as the proofs there given are undeniable, and very much regard the nervous fluid; it cannot be doubted, but the ſame power may have the like effect in a diſeaſe, in which this fluid ſuffers more remarkably perhaps than in any other whatſoever.

LOOKING over the hiſtories of the many patients I have attended in this deplorable condition, I obſerve about one half of the number to have been attacked with the ſpaſms preceding the *Hydrophobia*, either upon the full moon, or the day before it. And where this is only an influence concuring with inward cauſes of great force, it is not to be expected, but that

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(*g*) De imperio ſolis ac lunae.

thoſe ſhould often prevail without this external aſſiſtance.

But it is time to come to the cure, or rather the means of preventing the effects of this terrible poiſon. For all authors agree, that, after the appearance of the *Hydrophobia*, the caſe is almoſt deſperate: and the reaſon is plain from the deſcription we have given of it, a diſmal ſcene of the laſt ſtruggles and agonies of nature yielding up to the enemy.

The firſt care to be taken is of the wounded part. The ancient phyſicians *(h)*, who are followed in this by the moderns *(i)*, adviſe, where the place will admit of it,

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(*h*) Vid. Galen. de Ther. ad Piſ. l. i. c. 16. et Aetium l. vi. c. 24. et Celſum, l. v. c. 27.

(*i*) Hildan. Obſ. Cent. i. Obſ. 87.

to enlarge the wound by inciſion; to apply a cupping glaſs; to burn it with a hot iron; and to keep a diſcharge from the ulcer by drawing medicines for many days.

I CANNOT but ſay, that I think all this ſeverity needleſs. The deſign of it is to draw out the poiſon: but as it has been proved, that this immediately affects the nervous liquor, the miſchief muſt have taken place, before applications of this kind can be made.

I THEREFORE am of opinion, (becauſe it may however be of ſome ſervice to have a continued drain from the part) that it will be ſufficient to enlarge the wound a little, and dreſs it with *Ung. Baſilic. nig.* adding to it a ſmall quantity of *Mercur. praecip. rub.* as a digeſtive.

IT happens in moſt caſes, that the wound being ſmall, is healed up before the patient ſeeks for help. For this reaſon, and becauſe it is of no great conſequence whether it be cured or not, in the *Paper* which I printed and diſperſed ſome years ſince, intitled, *A certain cure for the bite of a Mad Dog*, I took no notice of any outward application: the rather, becauſe I thought, if any great ſtreſs was laid upon it, it might frighten thoſe who had neglected this care; and lead them to think, that the other part of the cure would not be effectual without it. And I can ſafely affirm, that (whether any outward application was made or not) I have never known this method to fail of ſucceſs, where it has been followed before the *Hydrophobia* began: although in the courſe of about thirty years (beſides the experience made by others, both in town and country) I have uſed it a thouſand times. I have often wiſhed, that I knew ſo *certain* a remedy in any other diſeaſe: I ſhall therefore give the reaſons of this method.

BUT before I proceed to the particulars of it, it may not be amiſs to mention the moſt conſiderable medicines, which have been formerly uſed in this caſe: for it will hence appear, that the like *intentions* have been purſued in all times, though by different ways.

THE injudicious jumbles of *Theriaca's*, ſpecific *Antidotes*, *etc.* whether old or new, deſerve no notice. That ridiculous *preſervative*, the *liver* of the Mad Dog, which *Pliny* ſays (*k*), ſhould be eaten rather raw than boiled, is neither good food nor phyſic. *Galen* (*l*) obſerved, that it availed nothing: and I remember to have ſeen a poor boy die mad, who had greedily devoured almoſt the whole of it.

THERE are two or three remedies recommended, I think, upon rational grounds. The firſt is the *Cineres cancrorum fluviatilium*, aſhes of the river Craw-fiſh. Theſe were prepared by burning the fiſh alive upon a copper-plate, with a fire made of the cutings of twigs of the white Briony. This *Galen* (*m*) avers that no body ever made uſe of without ſucceſs: and before

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(*k*) Hiſt. nat. l. xxix. c. 5.
(*l*) De ſimpl. med. facult. l. ii. c. 1.
(*m*) Ibid. l. iii. c. 34.

him *Dioſcorides* (*n*) aſſured, that it is a medicine which might be relied on. This calcined powder was given in large quantities, *viz.* a good ſpoonful or two every day for forty days together; either alone, or rather mixed with a ſmall portion of *Gentian root* and *Frankincenſe.*

ANOTHER medicine is the *Spongia Cynorrhodi, vel Roſae ſylveſtris*, the ſponge of the Dog-roſe, which is ſo celebrated an antidote againſt this and other animal poiſons, that *P. Boccone* (*o*), who has writen a whole diſcourſe upon its virtues, tells us, it is called in *Sicily*, *Sanatodos* or *All-heal.*

(*n*) De Theriac. c. 2.

(*o*) Muſeo di piante rare, Obſ. 2.

BESIDES theſe, the plant *alyſſum* or *madwort* had its name given it by the ancients, from its great efficacy againſt this madneſs. This was of two ſorts, one deſcribed by *Dioſcorides*, a *ſpecies* of the *Leucoium*, the other by *Galen*, a *Marrubium* (*p*). To theſe may be added *garlick*, *agrimony*, and *oxylapathum*.

Now it is remarkable, that all theſe remedies are powerful *diuretics*; the two firſt of the *animal*, the laſt of the *vegetable* kind. For, as Mr. *Ray (q)* has obſerved, the *Sponge of the Cynorrhodon* is an excreſcence formed upon the plant, as galls are upon the oak. If it be cut, 'tis found full of

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(*p*) Vid. Fab. Column. Phytobaſan. p. 27.
(*q*) Hiſt. Plant. tom. ii. p. 1471.

white worms, being the neſt of theſe inſects; which lodging here all the winter, do in the begining of the ſpring turn to flies, and quit their quarters.

ALL inſects abound with a diuretic ſalt: but as *Cantharides* do ſo more than any others, therefore the learned *Baccius (r)* goes farther, and, from the authority of *Rhazes* and *Joannes Damaſcenus*, adviſes to give theſe in ſubſtance for many days together. The preparation of this *antidote* (ſo he calls it) is by infuſing the flies in ſour butter-milk twenty-four hours, then drying them, and with the flour of lentils and wine making them up into troches of a ſcruple weight, of which one is to be taken every day: by which means he aſſures us, that though the pa-

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(r) De Venen. p. 89.

tient make bloody urine, yet that milk largely drank will abate that ſymptom, and that the *Hydrophobia* will be happily prevented. *Boccone* likewiſe informs us, that in *Upper Hungary* they give in this caſe five *Cantharides* in one doſe to men, and to beaſts a greater quantity (*s*).

I MUST add, that *Aetius*, (*t*), who has collected all the medicines he could from the old phyſicians, affirms, that himſelf knew an old man, who cured thoſe, who were bit, with *common ſorrel* only. He waſhed the wound with a decoction of this herb, and laid it on as a cataplaſm, and gave it in drink: by this means, the patient made a great quantity of turbid urine.

(*s*) Muſeo di fiſica. Obſerv. 21.

(*t*) Lib. vi. c. 24.

FROM hence it appears, that the ſureſt remedies in all ages againſt this venom have been ſuch, as provoke a great diſcharge by urine. Reflecting upon this, I thought it muſt be right to give to the public a courſe eaſily to be purſued, which by preventing the fever for a long time after the bite, and conſtantly promoting this evacuation, might ſecure the patient from danger. The method is this.

" LET the patient be blooded
" at the arm nine or ten ounces.
" Take of the herb, called in
" Latin *Lichen cinereus terreſtris*,
" in Engliſh *Aſh-coloured ground*
" *liverwort*, cleaned, dried, and
" powdered, half an ounce. Of
" black pepper powdered, two
" drachms. Mix theſe well toge-
" ther,

"ther, and divide the powder into
"four doſes, one of which
"muſt be taken every morning,
"faſting, for four mornings ſuc-
"ceſſively, in half a pint of cow's
"milk warm. After theſe four doſes
"are taken, the patient muſt go into
"the cold bath, or a cold ſpring,
"or river, every morning faſting,
"for a month: he muſt de dipt
"all over, but not ſtay in (with
"his head above water) longer
"than half a minute, if the water
"be very cold. After this he muſt
"go in three times a week for a
"fortnight longer."

THIS powder was firſt publiſhed in the *Philoſophical Tranſactions* (u), from Mr. *Dampier*, in whoſe family it had been kept as a ſecret many years: and in the year 1721, it was, at my deſire, put into the *Pharmacop. Lond.* by the name of *Pulvis antilyſſus.* I afterwards made this alteration only, of putting two parts of *Lichen* to one of pepper, inſtead of equal parts, becauſe I thought it too hot: and whereas but two or three doſes of it were formerly given, I repeated it four days.

(u) N°. 237.

The *Lichen*, like thoſe already mentioned, is a warm diuretic; the pepper is added, I ſuppoſe, to make it more agreeable to the ſtomach: for it is diſtaſteful and nauſeous.

THIS plant *(x)* is ſo remarkable for its virtue, that it may

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(*x*) Vid. Tab. iv.

not be amiſs to give a deſcription of it.

MR. *Ray*, ſo far as I can find, was the firſt who gave a diſtinct account of it (*y*), reckoning it among the *Lichens*. Our great botaniſt, Dr. *Dillenius*, has lately more exactly deſcribed it (*z*), and put it into the trible of the *moſſes*, calling it *Lichenoides digitatum cinereum*, *Lactucae foliis ſinuoſis*. It appears indeed to be of a ſubſtance between a *fungus* and a *muſcus*, ſoft, ſpongy and lanuginous. It grows cloſe to the ground, chiefly on heaths, and in woody, ſhady places, near the roots and ſtumps of trees; which being commonly covered with

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(*y*) Vid. Catal. Plant. Angl. ann. 1670. et Hiſtor. Plant.

(*z*) Hiſtor. Muſcorum, pag. 200.

creeping, moſſy herbs, it ſticks to them when it is gathered.

IT is found in all countries, and from *America* has been obſerved to be brought over with the *Peruvian* bark.

THE leaves when young are ſmall, but grow to two or three inches in length, and an inch or two in breadth, divided into ſeveral ſegments. They are ſometimes ſingle, ſometimes lying upon one another. At their extremities they produce little hard, oblong bodies, which the botaniſts call *Peltae*, and are undoubtedly the *ſeminal capſulae.* The leaves, when dry, are aſh-coloured, darker on the upper part; on the under, lighter. Frequent veins are obſerved along them, from which here and there run ſmall white fibres into the earth, the roots of the plant.

IT is found at all times of the year, eſpecially after rainy ſeaſons, that is, from autumn to winter: and therefore, as being in its freſheſt vigour, it ſhould always be gathered about that time.

I HAVE alſo examined it by diſtillation; by which four ounces of it yielded, of an acid water one ounce, five drachms, one ſcruple, and two grains; of oil heavier than water, two drachms, one ſcruple, ſixteen grains; of coal containing fixt ſalt, one ounce, two drachms, one ſcruple, eleven grains.

BUT I proceed in the cure. To make this more effectual, I added the uſe of cold bathing, which had never been recommended in this manner before. The ancients, as I ſhall obſerve preſently, never applied it till the *Hydrophobia* appeared; and the common practice among us of ſending the patient to the neareſt ſalt-water, as ſoon as may be, and there only to dip him all over twice or thrice, it is plain, cannot avail much to the prevention of a diſeaſe, which will not appear till about a month after; and therefore it ought to be continued for ſo long a time, if any advantage is to be expected from it: and I have indeed known many to have died raving, who had undergone this treatment. It is the preſſure of the water upon the ſurface of the body, and the conſtriction the cold makes upon the fibres of the ſkin and the ſmall tubes, which produce the good effect. The diſtenſion

tenſion of the veſſels by the fermenting humours is hereby repreſſed, and a flux of urine promoted for ſo many days, that all danger of the nervous fever, the conſequent of the inſtilled poiſon, is quite over. And if it ſhould be thought that ſalt-water, being heavier than freſh, will preſs more; this difference, in two or three immerſions only, can be but of ſmall moment, and is abundantly compenſated by the greater coldneſs of ſprings (which are uſually choſen for this purpoſe) than is felt in the ſea.

THUS I have made plunging into water effectual in preventing this diſeaſe, without the danger of drowning: whereas the ancients practiſed the ſame to remove it when it appeared, with ſome degree at leaſt of this hazard. For

Celſus (*a*), who ſeems firſt to have mentioned it, and ſays 'tis the only remedy, adviſes, if the patient can't ſwim, to let him be kept under water, that he may ſwallow it; and then at times be lifted out of it: if he can ſwim, to hold him under by force, that he may drink whether he will or not. This in ſhort is drowning and recovering by turns. And I make no queſtion, but ſo bold a practice was grounded on the authority of the *Greek* phyſicians, from whoſe rich ſtores this *Latin* author has extracted, and digeſted into a ſmall compaſs, the beſt

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(*a*) Unicum remedium eſt, nec opinantem in piſcinam non ante ei proviſam projicere, et, ſi natandi ſcientiam non habet, modò merſum bibere pati, modo attollere; ſi habet, interdum deprimere, ut invitus quoque aqua ſatietur: ſic enim ſimul et ſitis, et aquæ metus tollitur. Lib. v. cap. 27.

ſyſtem that ever was compoſed of medicine.

HOWEVER it be, the famous *Van Helmont* (*b*), in the begining of the laſt century, having obſerved the great effects of this practice in *Flanders*, recommended it in a very ſtrong manner. He ſaw an old man in the *Hydrophobia*, cured by ſubmerſion in ſalt water. He was firſt held under the water about four minutes, then taken out, and dipped again twice more, each time about a minute. When he was taken out, he really thought him quite dead; but being kept warm, and laid over a barrel, he vomited up the water he had ſwallowed, and recovered both his life and right ſenſes.

(*b*) Ortus Medicin. Demens idea.

HE relates another remarkable ſtory of the cure of the common *mania*, by being drowned in freſh water; and from this rightly concludes, that it makes no difference in the caſe, whether the water be ſalt or freſh. He juſtly remarks, that great care ſhould be taken not to give over for dead thoſe who are drowned: adding two remarkable inſtances of perſons who were brought to life, after they had lain under water half an hour. And to this purpoſe I remember, that an ingenious phyſician told me, that he had, not long ſince, in the country happened to ſave a man from the grave, who having been ſunk in a river more than twenty minutes, was judged to be paſt all hopes of recovery.

THERE are many accounts upon record of thoſe, who after having been drowned many hours have been brought to life (*c*). This ſhould certainly encourage the uſe of all means upon ſuch accidents, eſpecially ſince the trial is not difficult. The firſt ſtep ſhould be, to blow up the ſmoak of Tobacco into the inteſtins: then to warm the body by ſhaking and rolling it about, and rubbing it with warm cloaths in bed: in a word, to put the blood into motion by all manner of ways; and not to be diſcouraged, though no ſigns of life ſhould be diſcovered after an hour or two ſpent in this good work:

(*c*) Vid. Diſſertation ſur l'Incertitude des ſignes de la mort. Paris, 1742.

towards the latter end of which volatil ſpirits and ſalts may have a good effect. Neither ſhould bleeding be omitted, when the blood is become warm enough to drop out of the veins.

BUT to return from this (I think uſeful) digreſſion to the *Hydrophobia*, I muſt obſerve, that if *ſubmerſion* in this way be put in practice, it ought to be done upon the very firſt ſigns of the ſymptom, before the fever is come to its highth. For when it is ſo, there will not be natural ſtrength to overcome the ſhock: and I have always found, that at this time even common bathing has proved hurtful.

BUT experiments of this kind are perhaps rather to be permitted than injoined by phyſicians, for their own ſakes; though it is certain, that cures more dangerous than this are every day directed: but that is generally in caſes, where it cannot ſo evidently be known, whether the patient dies by the remedy or by the diſeaſe. In ſuch kind of attempts, the danger from the trial is to be weighed againſt that from the diſeaſe: if this outweighs, 'tis not only reaſonable but merciful, "even with a kind "of raſhneſs, as *Celſus* ſome-"where expreſſes it, to ſnatch "an opportunity of doing good "(*d*)."

AT leaſt there is more humanity in ſuch proceeding, than in ſtifling a miſerable wretch between

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(*d*) Cum quadam temeritate medicamenta arripere oportet.

two feather-beds: which, as I have been informed, is the practice in a neighbouring country, and ſometimes in our own.

BUT the greateſt comfort is, that at any time before this ſcene of horror opens, ſimple immerſion without drowning will prove effectual. For though it is beſt to begin the method preſcribed, as ſoon after the accident as it can be done; yet where it has been neglected, even till a day or two before the calamity might be expected, (as was judged from the begining anxiety and oppreſſion of the ſpirits) the ſucceſs has been the ſame.

BEFORE I quit this ſubject, I muſt take notice, (as I have hinted from *Van Helmont*) that this action of cold water upon the body, by preſſure and conſtriction, makes it of ſingular ſervice in the cure not only of *acute*, but alſo of *chronical deliria.* Doctor *Willis* (*e*) relates a very remarkable ſtory of a luſty young woman, who, having been raving mad ſeven or eight days, was by his order carried abroad at midnight, and thrown naked into a river, where ſhe ſwam about without help for more than a quarter of an hour; and taken out was put to bed, fell into a ſleep and large ſweats, and recovered without the help of any other remedy.

But there is no need of inſtances of this kind. Our phyſicians, who are moſt converſant

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(*e*) De Anima brutorum, part. patholog. cap. x. de delirio et phrenitide.

in the cure of theſe maladies, find by daily experience, that this practice has a very conſiderable ſhare not only in recovering their patients, but alſo in preventing a relapſe into the ſame miſery.

I am therefore ſorry to read in the *Philoſophical Tranſactions* (*f*), a remark of a learned gentleman, who, upon my recommending cold bathing, propoſes rather the uſe of the hot bath: becauſe "a "cold bath, he ſays, ſhuts the "pores, as a warm one opens "them." Surely he ſhould have known, that the ſhutting of the pores by a ſhort cold immerſion, is naturally followed by a glowing warmth, which relaxes and opens them; and by this means pro-

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(*f*) N°. 443.

motes perſpiration, without the diſtenſion of the veſſels by an inflammatory heat. I am afraid no bathing, whether hot or cold, would clear a head poſſeſſed with ſuch immechanical notions.

To ſay no more, whoever has rightly conſidered the *Bellinian* theory of *melancholy* and *maniacal* diſtempers (*g*), will eaſily ſee the reaſon of the ſurpriſing effects of this ſafe and eaſy application, in diſpelling the greateſt calamity, to which mankind is liable.

As to all other ways of curing the *Hydrophobia*, I own I have not been ſo happy as to find any ſucceſs from the many I have tried. Bathing, at this time, is ineffectual. I have taken away large quantities of blood; have given

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(*g*) Vid. Bellin. De morbis capitis.

opiates every three or four hours; tried *volatil ſalts*, *aſa foetida*, the *rad. valerian. ſylv.* with other *anti-epileptics*, in large doſes; as alſo the famous *Indian* remedy, *muſk* and *cinnabar*; laid on *bliſtering plaiſters*; cooled with nitre and emulſions of barly water, *&c.* All has been in vain, becauſe too late. And what is ſtill more diſcouraging is, that though ſometimes I have conquered the terrible ſymytom, and brought the patient to drink freely; yet he has died in twenty-four hours with a fever and convulſions: a plain proof of what we have ſaid of the manner, in which this poiſon operates.

HOWEVER, nothing is to be omitted to the laſt, be the proſpect never ſo bad: becauſe that may ſucceed in one patient, which has not in a hundred. I have by me a

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a letter from the learned Dr. *Boerhaave*, in which, with his uſual exactneſs and judgment, he relates two caſes of the *Hydrophobia*. In the firſt, according to the method mentioned in the *Hiſtory of the Royal Academy at Paris* (*h*), he ordered buckets of cold water to be poured, for a conſiderable time, upon the patient's head; and a *clyſter*, of warm water, *oxymel ſimplex*, and ſea ſalt, to be injected every four hours. By theſe means he was brought to drink freely of ſmall beer, and a decoction of marſh-mallow leaves, elder-flowers, and tamarinds: but notwithſtanding theſe hopes, he died convulſed, yet calm and in his ſenſes, in a few hours.

(*h*) An. 1699. pag. 49.

THE other caſe had a more happy event: for though the dread of liquids was attended with foaming, roaring, and the moſt miſchievous rage; yet by large doſes of nitre, (to which *laudanum* and *diacodium* were ſometimes added); by cooling the head continually with vinegar and roſe-water; bathing the feet for one hour, every night and morning, in warm water and vinegar, with ſalt; keeping the body open by tamarinds, ſyrup of violets, and frequent clyſters of water and nitre; and laſtly, eating almoſt conſtantly lemons with a little ſugar; the poor wretch was moſt perfectly recovered.

BUT I muſt here obſerve, that the uſe of all theſe things was entered upon four days before the dread of water began; by which means the violence of the diſeaſe was, without doubt, very much abated: and I have great reaſon to believe, from what I have experienced, (as I have already ſaid) that the method, I have recommended, would at that time even have prevented the calamity.

To conclude, if any relief could be expected in this deſperate ſtate; I think it would be from large bleeding, even *ad animi deliquium*, before the fibres of the membranes and veſſels have loſt their natural force by convulſions; nitrous medicines; and plentiful diluting with cooling ſubacid liquors. But after all, it will generally happen, that (as the *Greeks* ſaid upon deplorable caſes) "Death will be the phyſi-"cian that cures (*i*)."

(*i*) Ἰατρὸς ἰᾶται θάνατος.

ESSAY

ESSAY IV.

Of POISONOUS MINERALS *and* PLANTS.

THOUGH there be a great variety of internal poiſons, as well mineral as vegetable, yet they all manifeſtly agree in their primary effects and manner of operation; which (as is explained in the Introduction) are ſomewhat analogous to the miſchief from venomous bites or ſtings: the main difference lying in this, that in the one wounds are made outwardly, in the other inwardly, that is, in the ſtomach and bowels; but in both caſes, the animal oeconomy ſuffers in much the ſame way.

"POISONOUS medicines," ſays *Dioſcorides*, "are many; but the "alterations made by them in "the body common, and but "few (*a*)."

OF all this kind, thoſe of a mineral nature are the moſt violent and deadly, the greater gravity and ſolidity of their parts giving to theſe a force and action ſurpaſſing the miſchief of vegetable juices. And therefore whereas noxious plants vary their effects in different creatures, ſo as to prove harmleſs,

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(*a*) Ποικίλα μὲν γὰρ τὰ δηλητήρια Φάρμακα Κοιναὶ δὲ ϗ ȣ̓ πολλαὶ αἱ ἐξ αὐτῶν γινόμεναι διαθέσεις Alexiph. p. 399.

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nay perhaps beneficial and nutritive to ſome, as we have before obſerved *(b)*; the ſtrength of the ſtomach in theſe animals being ſufficient to conquer and divide ſuch corroſive ſubſtances, and their blood perhaps requiring to be recruited by ſuch warm and active particles; a mineral malignity is not, at leaſt ſo far as we know, conquerable by any, but becomes univerſally hurtful and deſtructive.

WE ſhall here give the firſt place to *Mercury ſublimate.*

THIS is nothing but a mixture of *quickſilver* with *common ſalt.* For, though it is always prepared with nitre and vitriol added to the *ſalt*, in different ways, the beſt of

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(*b*) See the Introduction.

which is that deſcribed by *Tachenius* (c); yet neither of theſe enter into the compoſition, ſerving only to facilitate the work, (which they do by uniting with the alcalin parts of the ſalt, and thus freeing its acid from them :) as abundantly appears from this experiment, that *mercury* ſublimed with the ſame proportion of nitre and vitriol, without ſalt, neither receives any increaſe of its weight, nor acquires any malignant quality.

The effects of this poiſon, when taken, are violent griping pains, with a diſtenſion of the belly; vomiting of a ſlimy, frothy matter, ſometimes mixt with blood and ſtools of the ſame; an intolerable heat and thirſt, with col ſweats, tremblings, convulſions

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(c) Hippocrates chymic. cap. xxiv.

etc. as will appear from the following hiſtory *(d)*.

To a large dog was given a drachm of *mercury ſublimate*, mixt with a little bread. Within a quarter of an hour he fell into terrible vomitings, caſting up frequently a viſcid, frothy *mucus*, every time more and more bloody, and purged the ſame downward: till tired and ſpent with this hard ſervice, he lay down quietly as it were to ſleep, but died the next morning.

The *abdomen* being opened, a great quantity of extravaſated blood was found between the liver and ſtomach, and between the duplicature of the *omentum* about the ſtomach; the guts as well as the ſtomach were diſtended, and full of a frothy bloody *mucus:* on the outſide they were of a livid colour, within all over red, and inflamed down to the very *rectum.* The fibrous coat of the ſtomach being taken off, between that and the nervous one, grumous blood was found in ſeveral places: the like was diſcovered here and there in the inteſtins between the ſame coats.

(d) Wepfer De cicut. aquatic. p. 300.

THE ſame ſymptoms with theſe, and manifeſt ſigns of a burning corroſion followed with ulcers in the bowels, *Baccius* (*e*) obſerved in a young man poiſoned by *ſublimate*, mixt with his meat.

WHAT we are here chiefly to examine is, how from ingredients

(*e*) De Venen. pag. 21.

ſingly innocent and harmleſs, ſo miſchievous a compound can reſult: for as the caſe is very plain with reſpect to ſalt, ſo is it likewiſe now notorious enough, that quick-ſilver it ſelf, which the ancients, *Dioſcorides*, *Galen*, *Pliny*, *etc.* have unjuſtly ranked among poiſons, is in many diſeaſes, inwardly taken, of very ſafe and beneficial uſe; and that not only when diſguiſed with ſulphur, ſugar, *etc.* but crude, without any correction, or vainly pretended mortification.

THIS the *Arabian* phyſicians firſt gave the hint of; *Avicen (f)* having obſerved, that " they, who

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(*f*) Can. Medic. l. iv. Fen. 6. Argentum vivum plurimum qui bibunt, non laeduntur eo: egreditur enim cum diſpoſitione ſuâ per inferiorem regionem.

" drink it in a large quantity, re-" ceive no hurt; its weight mak-" ing a free paſſage through the " body." This was encouragement enough for the practice of giving whole pounds of it in the *Iliac paſſion*: which is oftentimes done with good ſucceſs, without any frightful ſymptom accompanying the advantage received from its ponderoſity.

AFTERWARDS it plainly appeared that this mineral, either applied outwardly, or taken inwardly, though not in ſo great a doſe as could immediately force its way through the inteſtins, even when it was lodged for ſome time in this or that part, was not at all hurtful by any corroſive or malignant quality.

I remember, that I once found ſome quantity of it in the *perinaeum* of a ſubject taken from the gallows for a diſſection, (whoſe rotten bones diſcovered what diſeaſe had required the uſe of it, and that, I ſuppoſe, by unction) without any marks of corroſion of the part, where it was collected.

AND *Fallopius* (*g*), *Braſavolus* (*h*), with others of great note, confirmed its harmleſs efficacy in the cure of the worms, not only in adult perſons, but even in the more tender conſtitutions of children.

NOR are theſe the only caſes, in which good ſervice may be had

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(*g*) De Morb. Gallic. cap. lxxvi.

(*h*) De Morb. Gall. inter Autores de Morb. Gall. pag. 599.

from this weighty fluid. He that rightly conſiders the ſtate of the animal oeconomy, the various alterations it ſuffers from the ſtagnation of its more viſcid juices in the ſmalleſt canals, and how much the impulſe and force of the circulating blood, by which obſtructions are to be removed, muſt be increaſed by its carrying along with it ſuch particles as the mercurial *globuli*; will perhaps ſee good reaſon to allow, that the prudent management of quick-ſilver may do that in ſome obſtinate and dangerous diſeaſes, which we cannot promiſe our ſelves from any other of our known medicines whatſoever.

BUT I ſhall not enlarge upon this head. The learned Dr. *Cheyne* has thoroughly explained the mechaniſm, by which ſuch effects as theſe are produced (*i*). However, as all great medicines are to be looked upon as edge-tools, ſo this, as much as any, requires caution: and indeed more than is commonly obſerved by thoſe, who are moſt bold in the uſe of it.

FOR it cannot be denied, that the exceſſive gravity alone of this mineral, however ſerviceable in other reſpects, may, if it happens to lie in any quantity in the interſtices of the nervous filaments, induce ſymptoms of dangerous conſequence, as ſpaſms, contractions, palſies, *etc.* which we find they commonly ſuffer, who have either been for a long time employed in rubbing quick-ſilver upon looking-glaſſes, or in any work by which they are obliged to draw in mer-

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(*i*) New theory of continual fevers.

curial fumes with their breath, or who have been too much daubed with mercurial ointments; as ſhall be obſerved anon.

NEITHER is this all. Experience has convinced us, that repeated doſes of crude mercury have in ſome caſes, even a conſiderable time after they have been taken, exerted their force, and thrown the body into unexpected diſorders.

I remember two accidents of this kind (and one of them proved fatal), in which when ſmall quantities had been given for many days together, a violent ſalivation enſued, more than two months after the uſe of it had been left off.

AND not long ſince, I ſaw a young lady, who having ſwallowed about ſix drachms every morning, three ſucceſſive days, was ſalivated three weeks. The flux then ceaſed, but returned after ſix months, and held a month; and once more came on, in the ſame manner, two months after. The breath was each time ſtrongly affected, as is uſual in mercurial ſpittings. So ſurpriſingly active is this mineral, even ſimple and uncompounded.

WE may learn from hence, that it will be always right, in dealing with this ſlippery remedy, to take care that it has a free paſſage thro' the body; which muſt be done either by purging, or by combining it with ſubſtances, which will carry it off either by perſpiration or urine: for what is called *alcaliſing* it, does not deſerve the name of a preparation.

Now as to *ſublimate*, moſt certain it is, that the ſaline particles impart to the mercury this noxious quality; or, to ſpeak more properly, that the ſalt receives from the mercurial corpuſcles ſuch an increaſe of its gravity and *momentum*, as renders its cutting corroſion more effectual and penetrating: for the manner, after which this matter is done, is probably this.

THE compounding parts of the mercury, though ſo minutely divided by the action of the fire, as to riſe in the form of a fume, yet are ſtill ſolid and ponderous bodies: and by reaſon of their extreme parvity, being perhaps ſimple and elementary corpuſcles, they will eaſily be lodged in the pores and interſtices of the *ſaline* cryſtals; which being compoſed of the atoms of ſalt, variouſly by ſublimation combined and united, are a kind of cutting *lamellae* or blades; the force of which could never have been very penetrating, upon the account of their lightneſs and eaſy diſſolution, if the *mercury*, without blunting their edge, or breaking their figure, did not lend them an additional weight, and thus at the ſame time ſtrengthen their action, and prevent their quick ſolution by the juices of the ſtomach: which cannot now disjoin their compounding parts, becauſe the vacuities, into which they ſhould, in order to do this, inſinuate themſelves, are already poſſeſſed, and taken up by the mercurial globules.

IN ſhort, theſe cryſtals, which are to be conſidered as ſo many ſharp knives or daggers, wounding and ſtabbing the tender coats of the ſtomach, and abrading their natural *mucus*, will irritate the nervous liquor: upon which convulſions and vomitings, with exceſſive pains, muſt follow. And the blood-veſſels being at the ſame time pricked, all the adjacent parts will be inflamed, the blood will ſtagnate: then come on ulcers, which, tho' ſingly ſmall, yet being many in number, do all together make up large *gangrenes*.

THIS being the nature of *ſublimed mercury*, it may not be amiſs to inquire, how it comes to paſs, that this ſame compound reſublimed with live *mercury* in the proportion of four parts to three, (for the *ſublimate* will not take up an equal quantity) eſpecially if the work be repeated three or four times, loſes its corroſiveneſs to that degree as to become not only a ſafe, but, in many caſes, a noble medicine. For I do not ſee, that any of the chemical writers have hit upon the true ſolution of this *phaenomenon.*

HERE then it is to be conſidered, that the action of the ſaline cryſtals depending upon their ſolidity and largeneſs, theſe muſt neceſſarily, by every ſubſequent ſublimation, be broken into ſmaller and ſmaller parts. The mercurial globules, (for the reaſons given by the author of the forementioned *Theory of Fevers*) ariſing more quickly and eaſily than the ſalts, quit the interſtices in which they were lodged, and the cryſtallin blades are divided every time more and more by the force of the fire: whereupon a new combination of parts ſucceeds. And although there be a greater proportion of the mineral to the ſalts than before, which makes dulcified mercury ſpecifically heavier than the corroſive; (for this contains two parts of ſalt, and one of mercury; whereas the dulcified, well prepared, has equal parts) yet the broken pieces of the cryſtals uniting into little maſſes of differing figures from their former make, thoſe cutting points are now ſo much ſmaller, that they cannot make wounds deep enough to be equally miſchievous and deadly; and therefore do only vellicate and twitch the ſenſible membranes of the ſtomach to that degree, as excites them to an excretion of their contents and glandular juices, upward or downward, according as the force of irritation is greater or leſs.

THUS a violent poiſon is mitigated into a vomit or purge: nay, it may eaſily happen, (eſpecially in robuſt conſtitutions, and if the bowels be at the ſame time by any means defended againſt the ſtimulating power of the medicine) that this twitching may be ſo ſlight, as to be almoſt inſenſible, and hardly troubleſome. And then the mercurial globules, being freed indeed from moſt of the ſaline parts in their paſſage thro' the *primae viae*, but ſtill having a mixture of ſome few of them, are quickly conveyed into the blood: where, by their motion and weight, they muſt neceſſarily diſſolve the preternatural coheſions of all the liquors, particularly of thoſe, which circulate in the ſmalleſt canals, and are moſt viſcid and tenacious, making them more fluxil and thin, or of more eaſy ſecretion. Whereupon all the glands of the body are, as it were, ſet to work, and ſcoured of their contents: but the ſalival ones eſpecially, being many in number, very large and wide, and the juice they ſeparate of a tough and ropy ſubſtance, ſo that a conſiderable quantity of it is accumulated, before it is forced out at the orifices of the ducts; theſe effects will be moſt remarkable in them, and a ſalivation or ſpitting muſt continue ſo long, till the active mineral particles are, through theſe and the other paſſages, diſcharged out of the body.

As the difference between mercury corroſive and dulcified lies in a greater and leſſer degree of operation and force, ſo this ſame conſideration diſtinguiſhes the ſeveral preparations of this mineral from each other; which though very many, yet do all vary their effects in the body, only according as the mercurial globules are differently combined with ſalts, and the points of theſe more or leſs broken by the action of the fire, in the burning of ſpirits upon them, and ſuch like managements: and therefore however dignified with the great names of *Arcana*, *Panaceae*, *Prince*'s *Powders*, *etc.* they do not afford us any thing ſingular and extraordinary, beyond what we may with equal advantage promiſe our ſelves from ſome or other of the moſt common and uſual proceſſes.

WE may alſo fairly conclude from this reaſoning, that the ſafeſt way of raiſing a ſalivation is by internal medicines; ſince whatever miſchiefs can be apprehended from theſe, may in a greater degree follow from the external uſe of mercury: not only becauſe, as we have already hinted, the mineral globules, being intimately combined with ſalts in the ſeveral preparations given inwardly, will, by the irritation of theſe, be eaſily and fully thrown out at the organs of ſecretions, till the blood is quite diſcharged of its load; whereas in all the dawbings with mercurial ointments, we can never be certain, that none of the heavy particles are left lodged in the interſtices of the fibres, or cells of the bones; but alſo, in as much as by computing the portion of mercury in all the doſes neceſſary to promote a ſpitting, and the weight of the ſame mineral uſually applied when this is done by unction, it will appear that the quantity in the latter caſe vaſtly exceeds that in the former, and conſequently that the inconveniences to be feared will be in the ſame proportion.

THEREFORE this external management of quick-ſilver is chiefly to be recommended, where the conſtitution is not broken, or ulcers and tumors require a particular cure, by *liniments*, *etc.* and a more thorough cleanſing of the body. And even in ſuch caſes, it will certainly be beſt to anoint daily with ſmall quantities, and not to raiſe a high ſpitting; but promote the other ſecretions, particularly ſweating and urine, by plentiful drinking of thin liquors; and alſo, if there be occaſion, by laxative medicines; for it is well known, that cures are often wrought by theſe means, although the mouth has never been ulcerated by the mercury. At leaſt this method will be a remedy for a time, and inable the patient to recover ſtrength ; ſo that he may afterward, if it be neceſſary, undergo a more ſevere treatment.

IT may be obſerved, that as the earlieſt uſe of mercury was in unguents and emplaſters, ſo moſt of the prejudices and outcries againſt it are owing to effects produced this way. For the firſt attempts of the cure of venereal maladies by this remedy were learned from the *Arabians (k)*, who, having recommended mercurial ointments in the *lepra* or *ſcabies*, gave a handle to the *Italian* phyſicians to try their efficacy, in removing the foulneſs

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(*k*) Vid. Joan. Baptiſt. Montan. tract. De morb. Gallic. inter autor. De morb. Gall. p. 482. et Fallop. De morb. Gall. cap. lxxvi.

of the ſkin from a new and terrible contagion: neither were they ſparing of their liniments, which they continued to rub in for twelve, fifteen, nay ſometimes for above thirty days together (*l*). So that it is no wonder, if they often met with very untoward ſymptoms from ſo ſevere a treatment; and if (as ſome of them (*m*) affirm) they now and then found *mercury* in the rotten bones of their patients, who had, it may be, ſuffered too much both

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(*l*) Nicol. Maſſa De morb. Gall. tract. iv. cap. 2.

(*m*) Argentum vivum accepi ex oſſe cujuſdam corrupto, quem perunctum ab empyricis plus decies ferebant, non ſemel emanaviſſe. Anton. Gall. in lib. De ligno ſancto non permiſcendo.

Non ſemel in ſepulchris argentum vivum in mortuorum capitibus reperi. Anton. Muſa Braſavolus in tract. De morb. Gallic.

from their diſeaſe and their phyſician.

THERE are many hiſtories of this kind; neither are inſtances wanting in living perſons of *mercury* runing out of the body, from a tumor, either ſuppurated, or opened by a cauſtic: nay there is a caſe upon record, in which, upon opening a vein, ſome drachms of it flowed out with the blood (*n*).

TO this examination of the properties and effects of *mercury*, I ſhall add an inquiry into the nature of another *mineral poiſon*, not very unlike it, either in its make or action; this is *Arſenic.*

THERE is ſome confuſion in the accounts, which authors give

(*n*) Vid. Ephemerid. Germanic. Dec. 3. ann. 5. Obſerv. 172.

of this mineral. This ariſes from their not diſtinguiſhing the *arſenic* of the ancients from what is now ſo called. I ſhall therefore exactly deſcribe both the one and the other, not only from the lateſt writers of natural hiſtory, (for what *Agricola*, *Matthiolus*, *Schroder*, and even *Wepfer*, the beſt authors extant when this book was firſt publiſhed, have delivered to us on this ſubject, is all wrong) but more particularly from ſome experiments communicated to me by the learned Dr. *Hampe*, a moſt excellent chemiſt, phyſician to her royal highneſs the princeſs of *Wales*.

THE *Arſenic* of the *Greeks*, Ἀρσενικὸν or Ἀῤῥενικὸν, was what the *Latins* named *Auripigmentum*, we *Orpiment*.

THIS is found in *Greece* and *Hungary*, in particular mines and veins, and is never mixt with any other mineral. It is of a foliaceous or laminated texture, and contains a great deal of ſulphur: as appears by its inflammability, and by its giving, when mixt with *mercury ſublimate*, a true *cinnabar*. By ſimple fuſion it runs into a maſs of a cinnabarine colour, called *ſandaracha*. Though it yields a *regulus*, in every reſpect like to the *regulus* of true *arſenic*, yet it does not act as a ſtrong poiſon. *Hoffman* (*a*) gave a good quantity of it to a dog, without any harm. The reaſon of this is, becauſe its metallic particles are combined with ſulphur, and not with ſalt,

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(*a*) Obſerv. Phyſico-chym. l. iii. Obſ. 1.

at leaſt in any conſiderable degree.

SUCH a compoſition makes this ſubſtance more uſeful in painting than in phyſic; and, together with its colour, has induced thoſe chemiſts, who have fancied that metals may be tranſmuted, to take it for the ſubject matter of their great work; for ſo they call the making of gold. They have very fondly grounded their hopes upon ſome odd aenigmatical verſes in the *Sibylline Oracles* (*p*). But tho ſome learned men have attempted to explain this riddle, as deſcriptive of the *Greek* name Ἀρσενικὸν; yet none have ſo far ſucceeded, as fully to reconcile

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(*p*) Ἐννέα γράμματ᾽ ἔχω, τετρασύλλαβός εἰμι, νόει με.
Αἱ τρεῖς αἱ πρῶται δύο γράμματ᾽ ἔχουσιν ἑκάστη,
Ἡ λοιπὴ δὲ τὰ λοιπὰ, ϗ εἰσὶν ἄφωνα τὰ πέντε.
Τοῦ παντὸς δ᾽ ἀριθμοῦ ἑκατοντάδες εἰσὶ δὶς ὀκτὼ,
Καὶ τρεῖς τρὶς δεκάδες, ϗ δὶς τρία. Lib. i.

the numbers therein expreſſed at length, with thoſe contained in the letters, of which that word conſiſts (*q*). However, be that as it will, true it is, that this great expectation from this mineral is as old at leaſt as the time of *Caligula*; that is, of a more ancient date conſiderably, than the far greateſt part of theſe ſuppoſititious and ill-contrived compoſitions, which bear the ſacred name of *oracles*: for that covetous emperor, as *Pliny* relates (*r*), ordered a great quantity of *orpiment* to be melted and managed, that he might extract gold out of it; and made ſome, but (as it uſually happens in ſuch experiments) the profit did not anſwer the expence.

(*q*) Vid. Fabric. Bibl. Graec. V. xii. p. 696.
(*r*) Nat. Hiſt. lib. xxxiii. c. 4.

WHAT we now call *arſenic* is of three ſorts, white, yellow and red. All theſe are factitious, and very probably not known to the ancients. They are made in this manner.

AT *Schneebergh* in *Miſnia* there is found, in great quantities, a particular kind of mineral called *cobalt*, of a greyiſh colour, and ponderous. This roaſted and calcined, in a furnace made for that purpoſe, yields a white ſmoak, which gathers, at the end of a very long funnel, into an aſh-coloured powder, as fine as flower. This, with the addition of a true proportion of pot-aſh, is ſublimed, and gives the white cryſtallin arſenic (*s*).

(*s*) See Kunckel's Annotations upon Neri's Art of Glaſs, in German; and Philoſophical Tranſact. N°. 293.

The metallic earth, of a vitreous nature, which remains after this operation, melted with a due proportion of calcined flints and pot-aſh, makes what is called *Smalt*. The *cobalt* contains about three parts of *arſenic*, and one of this earth.

When newly ſublimed and perfectly pure, it is a ſhining white tranſparent body, not unlike to a metallic glaſs: in the air it changes its bright whiteneſs to a milky colour, and becomes entirely opake. It is not inflammable; but evaporates in the fire, without leaving any earth behind, in a white ſmoak, ſmelling like garlick. It affords a ſemimetallic *regulus*, both by ſublimation and precipitation. The firſt is foliaceous, light and ſpongy; the other ponderous, though alſo of a foliaceous texture, and reſembles *biſmuth*. This laſt *regulus* may be made without iron, with the black *Flux* only; or with nitre and tartar, in the ſame manner as is the regulus of *antimony*; but it requires a nice operator.

WHITE *arſenic* is entirely ſoluble in water. If one part of it be ſufficiently boiled in fifteen parts of diſtilled or rain-water, it gives by evaporation ſalts of triangular planes, which unite into *octoedral* cryſtals: and in theſe, either beat to powder, or diſſolved by boiling, metallic globules, reſembling thoſe of quick-ſilver, are plainly diſcovered by the microſcope. Which confirms what *Kunckel* ſays, that a great part of *arſenic* is *mercury (t)*: ſo that *arſenic* may

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(*t*) Chymical philoſophy confirm'd by experiments, chap. xi. in Pyrotechnical Diſcourſes. Lond. 1705. 8°.

be defined to be *a volatil metallic ſalt.*

YELLOW *arſenic* is prepared by ſubliming white *arſenic* with the addition of a tenth part of *ſulphur*. This is not ſo tranſparent as the white, but ſplendid, and very like to a metallic yellow glaſs.

THE *Red* differs from the *Yellow* only in this, that a greater quantity of *ſulphur* is added, together with a particular kind of a red cobalt called *kupfer nickel.*

THIS being the compoſition of this mineral, we may readily underſtand the manner of its deadly operation. The caſe is plainly the ſame with that of *ſublimate corroſive*: and as there the ſalts combined with the mercurial globules form cutting cryſtals; ſo here the metallic particles, which make the *regulus*, give a force and ſolidity to the ſaline bodies, which wound the ſtomach and guts, as the others do, even to ſuch a degree as to cauſe mortifications.

THE ſeveral hiſtories related by *Wepfer* (*u*) put this out of queſtion: it is ſufficient to our purpoſe to mention one.

A DOG having eat ſome fat mixed with white *arſenic*, died the next day. The upper part of the ſtomach, when opened, was red and inflamed; the coats thiner than ordinary; the bottom of it was covered with a fetid ſlime, and ſome pieces of fat: the thin guts were ſo corroded, as to be per-

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(*u*) Cicut. aquat. hiſt. p. 274. et ſeq.

vious in three places, two of the ulcers ſo large that they would eaſily admit a bean: the cavity of the *abdomen* contained a yellowiſh *ichor* tinged with blood.

THE caſe being thus, one would wonder, what ſhould induce authors to preſcribe ſo corroſive a mineral to be worn upon the pit of the ſtomach, as an *amulet* againſt the plague. This trick we may well believe to be dangerous, when *Lionardo di Capoa* (*x*) tells us of a child killed by the violent vomiting and purging, occaſioned from a ſlight wound made in the head by a comb wet with oil, in which *arſenic* had been infuſed: for the pores of the body being opened by

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(*x*) Incertezza de' medicamenti, p. 82.

heat and exerciſe, ſome of the noxious *effluvia* might eaſily inſinuate themſelves into the part. Accordingly *Crato* (*y*) obſerved an ulcer of the breaſt cauſed by this application; *Verzaſcha* (*z*) violent pains, and fainting fits; *Diemerbroeck* (*a*), and Dr. *Hodges* (*b*), death itſelf.

THE truth of the matter is, this practice ſeems to owe its origin to a miſtake. Perhaps ſome of the *Arabian* phyſicians had commended *darſini* worn in a bag for a preſervative in plague time. This in their language ſignifies *cinnamon*: but the *Latin* interpreters retaining the ſame word in their

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(*y*) Epiſtol. 168.
(*z*) Obſerv. 66.
(*a*) De peſte, Hiſtor. 99. Annotat.
(*b*) De peſte Londinenſ. p. 239.

tranſlations, (as was frequently done) one or other afterward not underſtanding its meaning, and deceived by the likeneſs of the ſound, ſubſtituted in its place *de arſenico*, as if *darſini* were all one with *zarnich*. The authority of the firſt author ſerved to propagate the error: nor were thoſe wanting, who reaſoned upon the matter, and found it agreeable to their philoſophy, that this mineral ſhould draw to it ſelf and concenter the *arſenical effluvia* out of the air, and thus ſecure the body from their infection; theſe being, as they imagined, the common cauſe of peſtilential diſeaſes.

HAVING thus particularly diſcourſed of the nature of theſe two poiſons, I ſhall not need to inſiſt upon any more out of the mineral kingdom.

ALL of them bear ſome analogy to the former, and are more or leſs dangerous, according as their ſalts receive a differing force from the metallic particles. For this reaſon, as we have obſerved, that the moſt virulent may be mitigated by breaking the points of the ſaline cryſtals; ſo on the other hand, the moſt innocent minerals may become corroſive, by combining them with ſalts: as we ſee in the ſeveral preparations of *ſilver*, *antimony*, *iron*, *etc.*

THIS puts me in mind of making a remark, which I think both curious and uſeful. It is obſerved, that the fumes of *lead* are very noxious to thoſe, who are conſtantly employed in melting it, as *Plumbers*, *Caſters of ſhot*, *etc.* A learned phyſician, of my acquaintance, lately told me, that a great artiſt in this way had aſſured him, he had found by experience, that this inconvenience did not attend the melting new lead, in any degree ſo much as it did the melting it when it was old: that he had workmen, who had for many years laboured under him, in caſting new metal, and had never ſuffered in their health by it. This difference he rightly aſcribed to the corroſive quality, which *lead* acquires from the ſalts in the air, by lying long expoſed to it.

FOR the fumes of minerals are only parts of the reſpective ſubſtances minutely divided; and therefore will not only produce ſuitable effects, but alſo in a more dangerous way; being not ſo much guarded againſt, and yet admitted farther into the body, that is, into the lungs, in reſpiration, as well as into the ſtomach, by means of the *ſaliva:* not to mention the impreſſion upon the ſpirits in the noſtrils, which muſt certainly be very conſiderable.

I HAD once in my poſſeſſion, given me by an ingenious chemiſt, a clear liquor, which though ponderous, was ſo volatil, that it would all fly away in the open air, without being heated; and ſo corroſive, that a glaſs ſtopple of the bottle, which contained it, was in a ſhort time ſo eroded, that it could never be taken out. The fume from it was ſo thin, that if a candle was ſet at ſome diſtance from the bottle, upon a table, the heat would direct its courſe that way; ſo that it might be poiſonous to any one that ſat near to the light, and to no body beſides. I know the compoſition of this *ſtygian* ſpirit; but it is better, that the world ſhould not be inſtructed in ſuch arts of death. It is ſufficient to our purpoſe to obſerve, that it was ſalts combined with metallic bodies.

Of POISONOUS PLANTS.

FROM *Minerals* we come to poiſonous *Plants.* The moſt noted of theſe are the *cicuta* and *aconitum.* The former is of two ſorts, our common *hemlock*; and the *aquatica*, which Mr. *Ray* calls *Cicutaria paluſtris tenuifolia.*

WHAT the *cicuta*, ſo much in uſe of old for killing, eſpecially at *Athens*, was, we don't know: it is moſt probable, that it was not a *ſimple* but *compounded* thing. The hiſtory of the noble death of *Socrates*, related by his diſciple *Plato* (*a*), (if this is not wrought

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(*a*) Phaedon. ſub finem.

up with more of *ornament* than *truth*) ſeems to evince it to have been a mixture of ſome anodyne juices with others of a corroſive nature. *Theophraſtus* (*b*) ſays, that *Thraſyas*, a great phyſician, had invented a compoſition, which would cauſe death without any pain; and that this was prepared with the juice of hemlock and *poppy* together, and did the buſineſs in a ſmall doſe.

AN extract of this kind might perhaps take away life with ſuch ſymptoms, as this great philoſopher went off with, *viz.* eyes fixt, heavineſs and inſenſibility in the legs, then great coldneſs in them, which by degrees ſeized the vital parts.

(*b*) Hiſtor. Plant. lib. ix. c. 17.

I AM the more inclined to believe this, from what is recorded anciently of the people of *Marſeilles*, that they had a poiſon kept by the public, in which *cicuta* was only an ingredient; a doſe of which was allowed by the magiſtrates to any one, who could ſhew a reaſon why he ſhould deſire death. For, this cuſtom, as *Valerius Maximus* obſerves *(c)*, came from *Greece*, particularly from the iſland *Ceos*, where he ſaw an example of it in a woman of great quality, who, having lived very happy ninety years, obtained leave to die this way, leſt by living longer ſhe ſhould happen to ſee a change of her good fortune.

(c) Lib. ii. c. 6. §. 8. Vid. Aelian. Var. Hiſt. l. iii. c. 37.

BUT the *cicuta aquatica*, at leaſt in our colder countries, is much more violent than the other. *Wepfer* has, in a very learned treatiſe, deſcribed its deadly effects in ſome children, who by miſtake had eat of the roots of it. Theſe were exceſſive pain and heat in the ſtomach; terrible convulſions, with the loſs of the ſenſes; diſtortion of the eyes; flowing of blood out at the ears; the jaws ſo hard ſhut that no force could open them; efforts to vomit, but nothing thrown up; frequent hickups; with a great diſtenſion and ſwelling, eſpecially at the pit of the ſtomach; and when death had concluded the tragedy, a continued runing of green froth at the mouth.

STALPART *vander Wiel* gives

the like account of two perſons killed at the *Hague* by the ſame roots (*d*).

IN a dog, that, for experiment's ſake, died by this poiſon, the ſtomach when opened was found quite conſtringed, and ſhut up at both orifices; its inward ſurface red, with livid ſpots here and there.

THUS it appears, that this plant conſiſts of hot, acrid and corroſive parts; which by rarefying the natural juices of the ſtomach, and hurting its nerves, are the cauſe of thoſe terrible diſorders, which have been deſcribed.

FOR, upon the ſenſe of a violent irritation and pain, the ner-

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(*d*) Obſervat. Cent. 1. Obſ. 43.

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vous fluid is by the mind, in a kind of ſurpriſe and hurry, determined in great quantities to the affected part; in order to throw off the cauſe of the diſagreeable ſenſation: which, if the *ſtimulus* be not over great, is done by the contraction of the fibres of the ſtomach, and muſcles of the *abdomen*, cauſing vomiting. But when the painful twitching is quite intolerable, the buſineſs is over-done; and the fibres are drawn into ſpaſms, which contract the mouth of the ſtomach, ſo that the noxious matter can't be diſcharged, but is kept there in continued force and action. And by the communication of the infection through the nervous ſyſtem, the whole body quickly ſuffers; the blood-veſſels are torn and broken by the violence of the convulſions, and blood guſhes out from the ears, noſtrils, *etc.*

THIS univerſal muſcular contraction was the reaſon, that one of the children, attended by *Wepfer*, made urine in the midſt of the agony, to the highth of five or ſix feet, with a ſtrength and violence ſurpriſing to the ſpectators.

THE caſe of the *aconitum* is much the ſame. This is our *napellus* or *monks-hood*; and its effects do ſo nearly agree with thoſe now related of the *cicuta*, that I ſhall not need to recite them: the experiments of *Wepfer (e)* are full and convincing. And indeed, as all the hiſtories, which this ſame author has ſo carefully given us, of trials made with ſeveral vegetable poiſons, as the *ſolanum*, *nux vomica*, *cocculus Indicus*,

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(*e*) Pag. 176. ſeq.

cus, etc. on different creatures, put it out of all doubt, that the common miſchief of theſe is a twitching and ſlight inflammation of the ſtomach, with an affection of the nervous fluid; ſo it appears from hence, that virulent Plants, although they may be diſtinguiſhed even from one another by particular virtues, do however kill by a like operation and force, which differs chiefly in degree from that of noxious minerals.

NOR is it at all ſtrange, that the ſymptoms from a vegetable, and from a mineral virulency, ſhould be ſo different, although of the ſame kind, and only of unequal force: for the more ſolid parts of minerals, eroding the coats of the ſtomach, induce a perfect mortification and gangrene, and thus do their work at once; whereas the weaker ſalts of *Plants* can make only pungent irritations, upon the painful ſenſe of which the animal is thrown into convulſions, and dies by theſe prevailing in all parts of the body.

UPON this ſcore, though mineral poiſons do not commonly paſs the *primae viae*, vegetable ones in ſome caſes may: juſt as we find that thoſe medicines, which have a great degree of irritation, preſently induce a vomiting; whereas the ſame twitching a little weakned ſuffers them to paſs into the inteſtins, and work downward by ſtools.

BY this we may perhaps give ſome gueſs at the nature of thoſe poiſons, with which they tell us the natives in ſome parts of *Africa* and *India* are ſo expert at killing, that they can do it in a longer or ſhorter time. Theſe are moſt probably either the fruits, or the inſpiſſated juices of corroſive plants, which inflaming the bowels, may cauſe little ulcers there, whoſe fatal conſequences, we know, may very well be ſlow and lingering.

This I am the rather induced to believe, becauſe an ingenious ſurgeon, who lived in *Guinea*, told me, that the antidote, by which the Negroes would ſometimes cure thoſe who were poiſoned, was the leaf of an herb, which purged both upward and downward. For by this means the ſtomach might be cleared from the adhering corroſive parts of the venom. Yet I can hardly think it poſſible at the ſame time, that they ſhould be able, by varying the compoſition or quantity of the doſe, to aſcertain the time in which it ſhall kill, to a week, month, *etc.* nor have I ever met with any perſon, who could atteſt this to be matter of fact: tho' repeated trials and obſervations may help one well practiſed in ſuch tricks to give notable conjectures in this point.

THE ancients indeed pretended much the ſame thing with their *aconitum*, of which they ſeem to have made a kind of ſecret and myſtery: as we learn from *Theophraſtus* (*f*), who ſays, "the ordering of this poiſon was different, according as it was deſigned to kill in two, three months, or a year." But this he relates only as a common tale or opinion, and not as a ſtory, to

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(*f*) Hiſt. Plant. l. ix. c. 16.

which himſelf gave any manner of credit.

IT is very plain, that the common cure of all poiſons, taken into the ſtomach, muſt be by throwing them up again by vomiting as ſoon as poſſible, and defending the membranes from their pungent acrimony. Drinking very large quantities of warm milk, with oil of ſweet almonds, till the vomiting ceaſes, will anſwer the firſt intention: the other, in mineral poiſons, (for the effects of the vegetable, after they have been vomited up, generally go off, by diluting plentifully with ſoft and fat liquids) requires particular care, which, I think, may be in this way. We have found the force of theſe to depend upon a combination of metallic particles with ſaline cryſtals: therefore the diſuniting of theſe muſt deſtroy their power. This (as *Kunckel* (*g*) has hinted) may be done, by drinking a quantity of a *lixivium*, made by a ſolution of *ſalt of tartar* in water: for this ſalt, uniting with the corroſive cryſtallin ſalt, will, (after ſome degree of effervescence) kill it, as the chemiſts ſpeak; by which means, being diſengaged from the mineral globules, it will be rendered of no effect.

THIS practiſe is founded upon a remarkable experiment, related by the ſame author, which is this. A child's head, for the cure of ſcabs, was dawbed over with an ointment made of *ung. pomat.* and *ſublimate corroſive*: this immediately cauſed ſuch a ſwelling, with

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(*g*) Chymical philoſophy confirm'd by experiments.

intenſe pain and inflammation, that the eyes and noſe could not be ſeen. In this extremity, when the patient was thought to be dying, a learned chemiſt, happily coming to the houſe, adviſed to foment the head all over with a ſtrong *lixivium:* this, in a few hours, quite removed the terrible ſymptoms.

WHAT ſuch an application could do outwardly, it may, upon the ſame rational grounds, be preſumed it will perform likewiſe in the ſtomach, at leaſt in ſome degree; and thus become an *antidote* againſt the moſt violent of all known poiſons.

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ESSAY V.

Of OPIUM.

THE ancients having experienced, that *Opium* would oftentimes kill, though taken in no large quantity, ranked it with poiſons, and gave it the firſt place among thoſe, which from their ſtupefying quality they called *narcotic.*

TRUE indeed it is, that we do every day find this to be, in a ſmall doſe, one of the moſt noble remedies in the world. But it is not worth the while to engage in the controverſy, how far poiſons are medicinal: ſince it is notorious enough, that medicines ſometimes prove poiſonous. And take the matter as we pleaſe, it may ſerve to very good purpoſes to underſtand the manner of operation of ſo celebrated a drug, and help us in a great meaſure to aſcertain its uſe in different caſes, if we are beforehand rightly appriſed of its nature and way of acting.

IN order hereunto, it is neceſſary, beſides ſome other *praecognita*, ſince one of the chief virtues of this medicine is *hypnotic*, to define diſtinctly what ſleep is, or rather, (to avoid confuſion and diſputes about words) what difference there is between an animal body, when aſleep and when awake: for I ſuppoſe the hiſtory, manner of preparing, *etc.* of *Opium*, to be already known.

FIRST then, there is no one but knows, that in ſleep there is a ceſſation from action. When waking, we walk, diſcourſe, move this or that limb, *etc.* but in natural and undiſturbed reſt there is nothing of all theſe: that is, whereas, being awake, we perform ſeveral motions by the voluntary contraction of our muſcles; when aſleep, thoſe muſcles only are contracted, whoſe action is in a manner involuntary, or to which the mind has always ſo conſtantly determined the ſpirits, that it does it by a habit, without the intervention of the reaſoning faculty: ſuch are thoſe of the heart and breaſt.

So that there is at this time a kind of relaxation or looſeneſs of the moving fibres of the ſeveral members; or at leaſt ſuch a quiet poſition and ſtate of them, by which all the antagoniſt muſcles are in an *aequilibrium* and equality of action, not overpowering one another. For this indeed ſeems to be one great deſign of ſleep, to recover to the parts over-ſtretched by labour their former tone and force: and therefore we naturally, when compoſing our ſelves to reſt, put our body into that poſture, which does moſt favour the particularly wearied limbs, and conduce to this end.

In the next place it is very plain, that there is in ſleep not only a reſt, and ſuſpenſion from acting, of moſt of our bodily organs, but even of our thinking faculty too; that is, (for I would prevent cavils) a ceaſing from ſuch thoughts, as when waking we are exerciſed about, which we reflect upon, and will to employ our mind with. For though dreams are thoughts, yet they are but imperfect and incoherent ones, and are indeed either ſo faint and languid repreſentations, as to be conſiſtent with our ſleep, as ſome may be: or elſe if they be ſtrong and lively, they are, as every one knows, the interruption and diſturbance of it.

FROM hence it will follow, that the motion of the arterial fluid muſt be, *caeteris paribus*, more ſedate, even and regular, in the time of ſleeping than waking. For, beſides the various alterations, which in the latter ſtate this receives from the ſeveral paſſions of the mind, the very contractions of the muſcles themſelves in exerciſes of the body differently forward its courſe: whereas in ſleep the force of the heart and pectoral muſcles being more conſtant and uniform, gives it a more calm and equally continued impulſe.

HENCE alſo it will come to paſs, that the influx of the liquor of the nerves into the organs of the body, as alſo its reflux towards the brain, is in ſleep either none, or very inconſiderable: that is, that this fluid has at this time but little or no motion. For 'tis muſcular action and ſenſation that require it to be thus determined this way or that, which are now hardly any. And yet by the arrival of blood at the brain, this juice will ſtill be ſeparated there, fit to be derived into its canals or tubes: ſo that by this means there will be a kind of accumulation, or laying up in ſtore, of ſpirits for the offices and requirements of waking.

THUS we may in ſhort look upon the time of watching, as the time of wearing out, or the deſtruction of the animal fabrick; and the time of ſleep, as that in which is is repaired and recruited: not only upon the account of what we have juſt mentioned concerning the nervous liquor, but alſo with reſpect to all the other parts, as well fluid as ſolid. For action does neceſſarily by degrees impair the ſprings and organs; and in motion ſomething is continually abraded and ſtruck off from the diſtractil fibres, which cannot otherwiſe

therwiſe be reſtored than by their being at reſt from tenſion. Beſides that, ſuch a regular and ſteady courſe of the blood, as we have obſerved to be in ſleep, is by far more fit and proper for nutrition, or an appoſition of parts to the veſſels, which an uneven hurry of it is more apt to tear off and waſh away.

THE caſe being thus, it is very plain, that whatſoever can induce ſuch a diſpoſition of the fluids and muſcular parts of the body, as this we have deſcribed, will ſo far cauſe ſleepineſs. And in like manner, when any thing interpoſes and hinders this compoſedneſs and tranquillity, the removing of the impediment will be the cauſing of ſleep: inaſmuch as this is only reducing the animal oeconomy to its right ſtate, in which by natural order there muſt be a ſucceſſion of ſleeping and waking.

THUS it appears how neceſſarily continued exerciſes make us ſleepy, ſince theſe exhauſt the juice of the nerves; that is, both leſſen its influx into the organs of motion, and incline the mind not to determine it any longer that way, upon the account of the pain and uneaſineſs, with which too violent a tenſion of the parts is always attended: which therefore we muſt needs deſire to relax, or lay to reſt.

THAT ſleepineſs, which follows upon a fulneſs of the ſtomach after eating or drinking, is owing to a different cauſe; and does indeed ſo nearly fall in with the effects of opiate medicines, that it requires a particular conſideration.

As hunger, or the emptineſs of the ſtomach, is a painful ſenſation; ſo the ſatisfying, or removing of this, is a pleaſing or agreeable one. Now all pain is a *ſtimulus* upon the part affected; and this, we all know, being attended with contractions of the pained membranes, cauſes a greater afflux than ordinary of the nervous juice that way. On the other hand, pleaſure, or a delightful ſenſation in any part, is accompanied with a ſmooth undulation, and eaſy reflux of the liquor of the nerves towards the brain. This is, as it were, the entertainment of the mind, with which being taken up, it does not determine the ſpirits to the organs of motion: that is, there is ſuch a relaxation of the muſcular fibres, and ſuch a diſpoſition of the nervous fluid, as we have obſerved to be neceſſary to ſleep.

THIS is the reaſon of that chillineſs in the limbs, which we commonly complain of after a good feaſt.

IF it ſeem ſtrange, that a pleaſure in the ſtomach ſhould ſo powerfully influence the mind; let it be conſidered, on the other hand, how violent effects an uneaſy and diſagreeable ſenſe in the ſame part does produce; what a terrible agony two or three grains of *crocus metallorum* throws the whole fabrick into; how readily the fluid of the nerves is with a more than ordinary *impetus* determined and commanded into the muſcles of the ſtomach and *abdomen*, in order to throw off the enemy, and remove the ungrateful ſenſation.

Now the conſequences, which we have aſcribed to a pleaſing ſenſe in this part, are only juſt the contrary of theſe, we find the oppoſite affection of pain induces. And indeed pleaſure and pain are two great ſprings of action in the animal oeconomy; the changes they make in the fabrick are the cauſes of many effects which ſeem ſurpriſing, becauſe we do not regard the mechaniſm, by which they are produced: but theſe muſt be more conſiderable in the ſtomach than any where elſe; this part being, for very wiſe purpoſes, of ſo acute a feeling, that ſome philoſophers have for this reaſon thought it to be the ſeat of the ſoul.

BESIDES this conſideration, we muſt take notice, that the ſtomach, being diſtended with food, preſſes upon the deſcending trunk of the *aorta*, and thus cauſes a greater fulneſs of the veſſels in the upper parts: whereupon the brain is loaded, or the derivation of ſpirits into the nerves diminiſhed, and inactivity or drowſineſs enſues. From hence proceed thoſe fluſhings in the face, redneſs, *etc.* after plentiful eating or drinking, moſt viſible in thoſe, whoſe veſſels are lax and weak: as in exhauſted and hectic perſons they more eſpecially are.

THUS we may, without the aſſiſtance of the new chyle entering into the veſſels, account for that inclination to ſleep, which follows upon a full ſtomach; though we muſt alſo allow the diſtenſion from this to be a conſiderable cauſe of the ſame effect. But this does not happen immediately, nay, ſometimes perhaps not within two or three hours after eating: and therefore the ſudden drowſineſs muſt (as well as the preſent refreſhment and reviving, which meat gives) be chiefly owing to ſome more ſpeedy alteration.

WE come then in the next place to *Opium* itſelf; the chemical *analyſis* of which, out of ſix ounces, afforded, of a volatil alcalin ſpirit, not very unlike to that drawn from harts-horn, two ounces; of fetid oil, five drachms, one ſcruple, ſixteen grains; of coal, void of ſalt, two ounces, two drachms, one ſcruple, four grains.

The virtues therefore of *Opium* are owing to a volatil *alcalin* ſalt, intimately mixt and combined with an oily, ſulphureous ſubſtance: the effects of which we muſt conſider, firſt of all upon the ſtomach, and afterwards, when they have paſſed the *primae viae*, upon the arterial fluid it ſelf.

AN agreeable ſenſation produced in the ſtomach, together with a diſtenſion of its membranes, we obſerved before to be the cauſe of that ſleepineſs, to which we are ſo prone after eating. The one of theſe engages the mind, the other acts upon the body. For pleaſure amuſes the ſoul, as it were, ſo that it does not think, or exerciſe it ſelf about any outward objects: that is, is inclined to reſt. And the fulneſs of the veſſels in the brain checks and hinders, in ſome meaſure, the derivation of the nervous juice into the organs, *etc.*

Now they, who take a moderate doſe of *Opium*, eſpecially if not long accuſtomed to it, are commonly ſo tranſported with the pleaſing ſenſe it induces, that they are, as they oftentimes expreſs themſelves, in Heaven: and tho' they do not always ſleep, (which proceeds from the preſentation of pleaſing images to the mind being ſo ſtrong, that like dreams they over-engage the fancy, and ſo interrupt the ſtate of reſt) yet they however enjoy ſo perfect an indolence and quiet, that no happineſs in the world can ſurpaſs the charms of this agreeable extaſy.

THUS we have from this medicine, but in a far more eminent degree, all thoſe effects, which we obſerved to follow upon that grateful ſenſe in the ſtomach, which a moderate fulneſs produces. For no bodies are ſo fit and able pleaſingly to affect our ſenſil membranes, as thoſe which conſiſt of volatil parts, whoſe activity is tempered and allayed by the ſmoothneſs of ſome lubricating and oily ones: which, by lightly rarefying the juices of the ſtomach, and cauſing a pleaſant titillation of its nervous coat, will induce an agreeable plenitude, and entertain the mind with ideas of ſatisfaction and delight.

THE caſe being thus, we eaſily ſee upon what mechaniſm the other virtues of *Opium* depend, its eaſing pains, checking immoderate evacuations, *etc.* not only in that the mind being taken up with a pleaſing ſenſe, is diverted from a diſagreeable one; but all pain being attended with a contraction of the part, that relaxation of the fibres, which it now cauſes, eludes and deſtroys the force of the *ſtimulus*.

IN like manner, in immoderate ſecretions there is moſt commonly an irritation of the organs, the removal of which will abate the diſcharge. And herein lies the incraſſating quality of this medicine, in that the twitching ſenſe upon the membranes of the lungs, bowels, *etc.* being now leſſened, the ſharp humor is ſuffered to lodge there in a greater quantity, before it is ſo troubleſome as to be thrown off and expell'd: it being all one as if there were no irritation of the part, if the uneaſy ſenſe thereof be not regarded by the mind.

THESE effects will all be hightened by the mixture of the opiate particles with the blood; which is hereupon rarefied, and diſtends its veſſels, eſpecially thoſe of the brain: and this does ſtill to a greater degree leſſen the influx of the nervous fluid to the parts, by preſſing upon the little *tubuli*, or canals, thro' which it is derived.

THIS is the reaſon of that difficulty of breathing, which they for a time experience, who take this kind of medicine: this ſymptom being inſeparable from the rarefaction of the blood in the lungs.

FROM hence it appears, that the action of *Opium* is very analogous to that of other volatil ſpirits, only that a ſmall portion of it has a force equal to that of a greater quantity of moſt of them.

THIS is very evident in thoſe, who accuſtom themſelves to take large doſes of it; as the *Turks* and *Perſians* do to that degree, that it is no uncommon thing there to eat a drachm or two at a time: for the effects of it in them are no other than downright drunkenneſs; upon which account (*a*) it is as common a ſaying with them, and on the ſame occaſion, "he has "eat Opium;" as with us, "he "has drank too much wine."

NEITHER indeed do they otherwiſe bear ſuch large quantities of it, than our tiplers will a great

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(*a*) Vid. Belon. Voyag. lib. iii. c. 15.

deal of brandy: that is, by habituating themſelves to it by degrees, begining with ſmall doſes, and requiring ſtill more and more to raiſe themſelves to the ſame pitch. Juſt as *Galen* (*b*) tells us of a woman at *Athens*, who by a gradual uſe had brought herſelf to take, without any hurt, a conſiderable quantity of *cicuta*, or hemlock. Which inſtance is the more to our purpoſe, becauſe *Nic. Fontanus* (*c*) knew one, who being recovered of the plague, and wanting ſleep, did, with very good effect, eat hemlock for ſome time; till falling ill again of a fever, and having left off the uſe of this remedy, he endeavoured to procure reſt by repeated doſes of *Opium*, which (nature having been accuſtomed

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(*b*) Simpl. Medicam. Facult. lib. iii. c. 18.
(*c*) Reſponſ. et Curat. Medic. p. 162.

to a ſtronger alterative) had no operation, till the help of *cicuta* was again called in with deſired ſucceſs.

IT is a ſufficient confirmation of all this reaſoning, that *Proſper Alpinus* (*d*) obſerved among the *Egyptians*, thoſe who had been accuſtomed to *Opium*, and were faint and languid thro' want of it, (as drinkers are if they have not their liquor) to be recovered, and put into the ſame ſtate of indolence and pleaſure, by large doſes of *Cretic* wine made hotter by the infuſion of pepper, and the like ſtrong aromatics.

NOR is it perhaps amiſs to remark, than in *maniacal* people, as is frequently obſerved, a quadruple doſe

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(*d*) Medicin. Aegypt. lib. iv. c. 1.

doſe of *Opium* will ſcarce produce any conſiderable effect. Now in perſons ſo affected, the mind is deeply engaged and taken up with ſome images, or other, as love, anger, *etc.* ſo that it is not to be ſo eaſily moved or diverted by thoſe pleaſing repreſentations, which it would attend to at another time, and upon which the virtues of this medicine in a great meaſure depend. Beſides this, thoſe who are *maniacal* do to a wonder bear the injuries of cold, hunger, *etc.* and have a prodigious degree of muſcular force; which argues the texture of their blood to be very ſtrong, and the coheſion of its globules great: ſo that the ſpirituous parts of the opiate cannot make that disjunction and rarefaction of this fluid in them, which it does in ordinary bodies and conſtitutions.

MANY are the improvements, which might be made of this theory, with relation to the practice of phyſic: but theſe will be obvious enough to one inſtructed in the animal oeconomy.

I CANNOT, however, omit two uſeful remarks from it. The firſt is, that by not underſtanding the manner, in which this noble medicine acts, when it checks immoderate ſecretions, phyſicians are often led into wrong methods, and give it to ſtop thoſe evacuations, in which there are no ſpaſms or painful irritations; as particularly, in colliquative *Diarrhoea's* attending hectic fevers: whereas, it is manifeſt, it muſt in ſuch caſes (without the deſired effect) do real miſchief, by relaxing the fibres, and heating and rarefying the fluids, already too thin and broken in their texture.

AND, on the other hand, it is eaſily ſeen, that this ſame property, by which it takes off cramps in the nerves, and thus cures excretions depending upon them, will very often happily promote thoſe diſcharges which are natural, when they are unſeaſonably interrupted by violent contractions. Thus opiates, in *nephritic* pains, move the urine ſtopped by gravel and ſtones; and, in *uterine* caſes, aſſiſt nature in propelling the *menſes*, the *foetus* and the *lochia*.

To conclude then, it is very plain, that there needs no more to make *Opium* prove deſtructive or a poiſon, than to take too great a quantity of it: for then it muſt inflame the ſtomach, and rarefy the blood to ſuch a degree, that the veſſels cannot again recover their tone; whereupon apoplectic ſymptoms, *etc.* will enſue.

To be convinced of this, I forced into the ſtomach of a ſmall dog about half a drachm of crude *Opium* diſſolved in boiling water. He quickly vomited it up with a great quantity of frothy ſpittle; but repeating the trial, by holding up his head, and beating him, I made him retain three or four doſes, intermitting between each about a quarter of an hour. When he had thus taken, as I could gueſs, near two drachms, I watched him about an hour: then he began to ſleep, but preſently ſtarted up with convulſions, fell into univerſal tremblings, his head conſtantly twitched and ſhaking, he breathed ſhort and with labour, loſt entirely the uſe firſt of his hinder legs, and then of the fore ones, which were ſtiff and rigid like ſticks. As he lay ſnorting, to haſten his end, I was giving him more of the ſolution; but on a ſudden his limbs grew limber, and he died.

OPENING his ſtomach, I found it wonderfully diſtended, though empty of every thing but ſome water and *Opium*; parcels of frothy *mucus* ſwimming in it: the inſide was as clean as if ſcraped and waſhed from all the ſlime of the glands, with ſome redneſs here and there, as in a begining inflammation. The *pylorus* was contracted. The blood-veſſels of the brain were very full: and I took out a large grume of concrete blood from the upper part of it, cutting into the *ſinus longitudinalis*, as is not uncommon in apoplectic carcaſes; but found no extravaſated *ſerum* in the *ventricles*, nor among any of the membranes.

As to the cure in ſuch caſes; beſides emptying by vomiting, bleeding and bliſtering, acid medicines and lixivial ſalts are the proper remedies. Theſe contract the relaxed fibres, and by their diuretic force make a depletion of the veſſels. I have particularly, with extraordinary ſucceſs, given repeated doſes of a mixture of *ſalt of wormwood* with *juice of lemons.* This is the foundation, upon which *van Helmont* prepared his *laudanum cydoniatum*, and *Starkey* his *pacific pill.* Generous *wine*, which the ancients gave for an *antidote*, can be no other ways uſeful,

ful, than as it diſſolves the *reſinous* clammy part of the *Opium* ſticking to the coats of the ſtomach, and ſo forwards its expulſion by other helps, which cauſe a contraction of the muſcular fibres.

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AS an *Appendix* to this diſcourſe, I ſhall ſubjoin an account of another Poiſon, very different from any we have deſcribed, but nearly related to thoſe called *narcotic.*

THIS is the *ſimple water* diſtilled from the leaves of the *Lauro-ceraſus* or *common laurel:* the bad effects of which were firſt obſerved ſome years ſince in *Ireland*; where, for the ſake of its flavour, it was frequently mixed with brandy.

A SMALL quantity of this killed two women, who drank it, very ſuddenly. Hereupon a learned phyſician, ſurpriſed at the event, (this plant having never been thought to be any ways noxious) made ſeveral experiments with it upon dogs, which were afterwards, ſome of them, repeated here, with the ſame fatal ſucceſs (*a*).

FROM all theſe, but more particularly from obſervations communicated to me by Dr. *Nicholls*, (which he had made in his anatomical lectures) I ſhall give a ſhort deſcription of the appearances in the animals put to death in this uncommon way.

(*a*) Vid. Philoſoph. Tranſact. N°. 418 and 420.

ALL the dogs fell immediately into totterings and convulſions of the limbs, which were preſently followed by a total *paralyſis*, ſo that no motion could be excited even by pricking or cutting them.

No inflammation, upon diſſection, was ſeen in any of the internal membranes. The moſt remarkable thing was, a great fulneſs and diſtenſion of the veins, in which the blood was ſo fluid, that even the lymph in its veſſels was generally found tinged with red.

The ſame water, injected, as a clyſter, into the inteſtins, had always the like effects, in a very few minutes.

To make the manner of acting of this poiſon more evident, Dr.

Nicholls prepared a quantity of it much ſtronger than ordinary, by *cohobating*, (as the chemiſts call it) or diſtilling it twice from freſh leaves. By this proceeding he had about a drachm of a heavy oil, of the colour of olive oil, ſubſiding at the bottom of about three pints of water: this, by frequent ſhaking, was quite incorporated again with the water.

ABOUT two ounces of this killed a middle-ſized dog, in leſs than half a minute, even while it was paſſing down the throat.

I DON'T know a more convincing proof of what I have all along affirmed, that all poiſons act principally upon the nervous fluid, than this ſeemingly innocent water gives us. That a ſimple liquor, without any extraordinary ſenſible qualities, ſhould even in its paſſage into the ſtomach, nay when thrown into the lower guts as a clyſter, inſtantaneouſly kill, and that without any marks of inflammation or corroſion, can no other way be accounted for, but by an immediate effect upon the animal ſpirits.

IF what I have, in the Introduction, conjectured concerning the nature of the nervous fluid, be right; the *elaſtic matter*, which enters into its compoſition, muſt in the membranes ſuffer a *repulſion* from ſome active particles in this water: (as we ſee in many experiments of *electricity*, it is in this manner affected by ſeveral bodies meeting with it) in conſequence of which, the nerves, firſt of the membranes which it touches, and then of all the organs, muſt loſe their action. Hence it is that animals killed this way, after ſtrong convulſions, die univerſally paralytic: and a ſudden ſtop being put to the circulation, the blood remains in perfect fluidity in the veins.

MORE will be ſaid to this purpoſe in the following Eſſay. I ſhall only add here, that the deadly power of this water ſeems to be intirely owing to its being over-ſaturated with that *heavy oil*, which we have mentioned: and therefore Dr. *Nicholls* experienced, that ten drops of a *red oil*, (like to this, of a *kernelly* flavour and taſte) diſtilled in the ſame manner from *bitter almonds*, (after the ſweet oil had been expreſſed) mixt with an ounce of common water, in like manner, killed a dog in about half an hour.

CONSIDERING all this, and that it would be a confirmation of what I have aſſerted, if the application of ſuch ſubſtances, as draw back the ſpirits to their membranes, ſhould, by an irritating force, contrary to the repelling liquor, revive the dying animal; we gave to a ſmall dog about an ounce of ſtrong *laurel-water*. He fell immediately into moſt violent convulſions, which were ſoon followed by a total loſs of his limbs. When he ſeemed to be expiring, we held to his noſtrils a phial of good ſpirit of *ſal ammoniac*, and forced a ſmall quantity of the ſame down his throat: he inſtantly felt its virtue, and, by continuing the uſe of it for ſome time, by degrees recovered the motion of his legs; and, in about two hours, walked about with tolerable ſtrength, and was afterwards perfectly well.

THE *antidote* ſhews the nature of the *poiſon*; and I make no doubt but the ſame will prove effectual againſt any others of this kind, which, without an inflaming quality, ſtupefy, and ſtop the motion of the nervous fluid.

I GIVE this hint, becauſe it is well known, that the kernels of ſome fruits, particularly of *black cherries*, afford by diſtillation a water, in taſte and ſmell, not unlike to that from laurel or bitter almonds: which, if drawn off very ſtrong, or over-impregnated with the heavy oil, may certainly cauſe the like bad ſymptoms. Some trials, as I am informed, have proved this to be ſo. Upon this account, I think our ſhops had better be without this water; eſpecially ſince it is not known to have any medicinal virtue, and is commonly given to infants, eaſily affected, and ſubject to convulſions, the very diſorder, which waters of this kind have been found to produce.

ESSAY VI.

Of venomous exhalations from the EARTH, *poiſonous* AIRS *and* WATERS.

BESIDES theſe already treated of, there is yet another way of being poiſoned, and that is by *venomous ſteams* and *exhalations*, or a poiſonous air taken into the body by the breath.

THIS is notorious enough, and authors upon many occaſions make mention of it; but when they come to explain the particular manner how this kills, they moſt commonly reduce it to ſome of the poiſons, which prove deſtructive by being admitted into the ſtomach: alledging that malignant fumes and airs are therefore fatal, becauſe impregnated with *arſenical*, *mercurial*, and the like hurtful μιάσματα or particles, they convey theſe into the body; which being of a very corroſive nature, muſt neceſſarily do hurt both to the fluid and ſolid parts.

AND indeed that the fumes of theſe ſame minerals are very pernicious, and air filled with their atoms very unfit for reſpiration, is moſt certain; but to argue from hence, that all deadly vapours and malignant airs owe their miſchief to theſe only, is too fond and ill-grounded a conceit: ſince upon a due inquiry it will appear, that there may be, and are, mortiferous exhalations from the earth, infecting the air, of a nature ſo different from any of thoſe poiſons; that the very ſubſtance, from which they ariſe, may not be at all hurtful, though taken into the ſtomach it ſelf.

VENOMOUS ſteams and damps from the earth the *Latins* in one word called *mephites* (*a*).

THIS, as many other *Tuſcan* words, comes from a *Syriac* theme, which

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(*a*) Virgil. Aen. vii. v. 84.
——Saevamque exhalat opaca mephitim.
Vid. Servium, ibid.

which ſignifies to blow or breathe (*b*). And in ancient times ſeveral places were remarkable for them: ſo the *Mephitis* of *Hierapolis* was very famous, of which *Cicero*, *Galen*, but more particularly, and from his own ſight and knowledge, *Strabo* (*c*) makes mention.

SUCH another was the *ſpecus Corycius* in *Cilicia*, which, upon the account of its ſtinking deadly air, ſuch as is thought to proceed from the mouth of dragons, which the poets give to *Typhon*, was called *cubile Typhonis*. This *Pompon. Mela (d)* deſcribes; and it is indeed as ancient as *Homer* (*e*):

(*b*) Scaliger, Conject. in Varron.

(*c*) Lib. xiii.

(*d*) De Situ Orb. lib. i. c. 13.

(*e*) Εἰν Ἀρίμοις ὅθι φασὶ Τυφώεος ἔμμεναι εὐνάς. Il. β. ℣ 783.

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for *Arima*, in which he places it, was, as *Euſtathius* obſerves, a mountain of *Cilicia*.

NEITHER are ſuch fumes as theſe now infrequent; and tho' moſtly found in mines, pits, and other ſubterraneous places, yet they are ſometimes met with on the ſurface of the earth too, eſpecially in countries fruitful of minerals, or pregnant with imbowelled fires: ſuch are *Hungary* and *Italy*, which latter, as *Seneca* (*f*) take notice, has always been remarkable for them.

I SHALL therefore, having had the opportunity of making ſome remarks upon one of the moſt famous of all in thoſe parts, give as good an account as I can of that, and its manner of killing; which

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(*f*) Nat. Quaeſt. l. vi. c. 28.

though I dare not affirm to be applicable to every *mephitis*, yet ſeems plainly to be the caſe of moſt of them: and where it is not, this ſimple miſchief will only be found to be complicated with another; and then ſome extraordinary ſymptoms, or appearances in the animals killed, will eaſily make a diſcovery of the additional venom and malignity.

THIS celebrated *Mofeta*, taken notice of (or at leaſt ſome other hereabouts) even in the time of *Pliny* (g), is about two miles diſtant from *Naples*, juſt by the *Lago d' Agnano*, in the way to *Pozzuolo* or *Puteoli*, and is commonly called *la Grotta de' Cani*: becauſe the experiment of its deadly nature is frequently made upon dogs;

(g) Nat. Hiſt. l. ii. c. 93.

though it be as certainly fatal to any other animal, if it come within the reach of its vapour. For *Charles the eighth of France* proved it ſo upon an aſs; and two ſlaves put into it by order of *D. Pietro di Toledo*, viceroy of *Naples*, with their heads held down to the earth, were both killed (*h*).

IT is a ſmall *grotta* at the foot of a little hill, about eight feet high, twelve long, and ſix broad. From the ground ariſes a thin, ſubtle, warm *fume*, viſible enough to a diſcerning eye, which does not ſpring up in little parcels here and there, but is one continued ſteam, covering the whole ſurface of the bottom of the cave; and has this remarkable difference from common vapours, that it does not, like

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(*h*) L. di Capoa delle Moſet. pag. 37.

ſmoak, diſperſe it ſelf into the air, but quickly after its riſe falls back again, and returns to the earth; the colour of the ſides of the *grotta* being the meaſure of its aſcent: for ſo far it is of a darkiſh green, but higher only common earth, and this is about ten inches. And therefore as I found no inconvenience by ſtanding in it, ſo no animal, if its head be kept above this mark, is in the leaſt injured. But when (as the manner is) a dog, or any other creature, is forcibly held below it, or by reaſon of its ſmallneſs cannot hold its head above it; it preſently, like one ſtunned, loſes all motion, falls down as dead, or in a ſwoon, the limbs convulſed and trembling, till at laſt no more ſign of life appears, than a very weak and almoſt inſenſible beating of the heart and arteries: which, if the animal be left there a little longer, quickly ceaſes too; and then the caſe is irrecoverable, as in one perfectly ſtrangled. But if it be taken out in time, and laid in the open air, it ſoon comes to life again; and ſooner, if thrown into the adjacent lake, which by conſtringing the fibres of the ſkin, in the manner of a cold bath, puts the blood again into its circulation.

IT will afford ſome light towards the knowledge of the nature of this fume, to mention ſome other experiments made in the *grotta* (*i*). A lighted torch, ſnuff and all, goes out in a moment, when dippid into the vapour.

A PISTOL cannot take fire in it. If a weather-glaſs be ſo fixed

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(*i*) Addiſon's Remarks on Italy, p. 230.

in the *grotta*, that the *ſtagnum* is wholly covered with the vapour; the quick-ſilver neither falls nor riſes otherwiſe than in the outward air.

IN this ſhort, but accurate hiſtory of this *grotta*, I have ſet down thoſe particulars, which not only diſtinguiſh *mephitical* exhalations from common and innocent fumes, but alſo give hints ſufficient, I think, to determine the reaſon and manner of their ſurpriſing effects.

AND not to ſpend time in refuting the opinion of others, I firſt take notice, that here can be no ſuſpicion of any ſuch poiſon as we have deſcribed: if there was, animals taken out of the *grotta* could not ſo immediately recover from the effects of it, without any remaining appearance of faintneſs and ſickneſs, or ſuch ſymptoms as are ſuffered from inſpiring air impregnated with corroſive *effluvia*; and theſe would certainly, in ſome degree at leaſt, infect the air in the upper part of the cave, which is always pure and fit for reſpiration. Neither could a miſchief of this kind be produced, without ſome marks of it in the creatures killed, when opened: which yet diſcover nothing extraordinary, either in the fluid or ſolid parts, except what I ſhall preſently mention in frogs.

IN order therefore to underſtand wherein this deadly power conſiſts, it muſt be obſerved, that the uſe of reſpiration is twofold; the firſt, that the blood, in its paſſage thro' the lungs, may by the elaſticity of the air, diſtending the *veſiculae*, and thus preſſing upon the arteries, (*k*) be comminuted and broken, ſo that no coheſion of its parts may hinder the ſecretion of thoſe humors, which in the ſeveral glands are to be derived from it: the other is, that the blood may be ſupplied with ſomething from the air, whatever it be, neceſſary to life.

THAT there is a vivifying matter from the air, which paſſes into the blood by the breath, I have in another place (*l*) demonſtrated by obſerving, that the ſame quantity of it will not ſuffice long for breathing, though it be deprived of none of thoſe qualities, by which it is fitted to inflate the lungs, and

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(*k*) Vid. Malpigh. De pulmon. et Bellin. Opuſcula.

(*l*) Diſcourſe on the Plague. 9th Edit. pag. 45.

agitate the blood. And likewiſe, from the experiment of Dr. *Halley*, who, when ſeveral fathom under water, in his *Diving Engine*, breathing an air more condenſed than the natural, found that he drew his breath more ſlowly than uſual: the reaſon of which muſt be this, that when a greater quantity of air than ordinary was taken in at a time, and conſequently the blood furniſhed with more of thoſe particles, which are neceſſary to be mixed with it, a leſs frequent reſpiration ſufficed.

THE caſe being thus, ſince (as we have mentioned) the mercury in the barometer is not altered in its aſcent by this vapour, that is, there is no want of gravity and elaſtic preſſure in it, at leaſt not to a conſiderable degree; we muſt conclude, that there is ſome quality in it, which, when it is drawn into the lungs, prevents and ſtops the uſual communication of the inlivening ſpirit from the air to the blood.

WE have already taken notice, that there can be no real poiſon here. All that is diſcovered by the earth from which the fume ariſes, is no more than that it is of a greeniſh colour, with a ſubacid taſte, very much (as *L. di Capoa* obſerves) like to that of the phlegm of vitriol: ſo that it may very well be called an unctuous vapour, of the *vitriolic* kind, raiſed by a ſubterraneous heat.

IT is certainly neceſſary to the inflation of the *pulmonary veſiculae*, and the ſubſequent entrance of the ſubtil matter from the air into the blood, that the nervous liquor ſhould have a free courſe into them: it is therefore highly probable, that theſe vitriolic particles in the fume have a counter-action or repulſive force to the elaſtic matter of this liquor; by means of which the *fibrillae*, into which it ſhould paſs, being deſtitute of it, become quite relaxed and loſe their force (*m*).

NEITHER muſt it ſeem ſtrange, that the animal ſpirits ſhould be ſo ſuddenly interrupted in their action, by the interpoſition of a ponderous fluid; ſince we ſee every day how inſtantaneouſly, on the other hand, their motion is quickened and revived by the application, to the noſtrils, of volatil ſalts: and it may be obſerved, that theſe are always *alcalin*, that is, of a nature quite oppoſite to *vitriolic*

(*m*) Vid. Eſſay V. at the end.

or acid ſpirits, ſo as readily to fall into a conflict or fermentation with them.

To conclude this part of our diſcourſe; I think it a ſufficient confirmation of this reaſoning, that in frogs killed in this *grotta*, the bladders of the lungs (more viſible otherwiſe and diſtinct in theſe creatures than in moſt other) were found ſubſided and quite empty of air (*n*). But if any one deſires a farther proof, he may, according to theſe principles, make, as *L. di Capoa* did, (*o*) an artificial *Mephitis*: for if *Antimony*, *Biſmuth*, or any other ſuch mineral, be finely powdered, and moiſtened with *Aqua fortis*, or *Spirit of Nitre*; there will ariſe a great heat, with a thick

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(*n*) L. di Capoa, Mofet. pag. 40.
(*o*) Ibid. pag. 128.

dark ſmoak, in which, as in this *grotta*, torches are extinguiſhed, and animals, though but ſlowly, ſtifled and killed.

THE mortal effects of *ſubterraneous damps*, in mines, deep wells, and the like cloſe places; as alſo of the fumes of confined burning charcoal, may be accounted for in the ſame way: theſe being generally acid exhalations from mineral ſubſtances (*p*). And as in animals, which have died in the deſcribed *grotta*, the veſicles of the lungs are found ſubſided, wanting due tenſion from the animal ſpirits; ſo in the diſſection of a man killed by the vapour of wood coals, carried from a baker's oven into a deep cellar, as the ſtory is related in the *Memoirs of the Royal Aca-*

(*p*) Vid. Philoſ. Tranſ. N°. 411. et 429.

demy at Paris (*q*), the brain appeared dry, and the muſcles of the arms and thighs ſo relaxed, that they ſeemed ſeparated from the parts, to which they belonged.

BUT it muſt here be obſerved, that, in ſome caſes of this nature, the mineral particles are mixed with ſo ſmall a proportion of water, that, inſtead of extinguiſhing a flame, they will themſelves, like gunpowder, take fire, and burn at the approach of a candle. A famous inſtance of ſuch a vapour is given in our *Philoſophical Tranſactions* (*r*): and an experiment, made by a mixture of oil of vitriol and filings of iron, confirms the truth of our reaſonings on this head.

(*q*) Ann. 1710. pag. 17.
(*r*) N°. 442.

THUS I have ſhewn how death may enter at the noſtrils, though nothing properly venomous be inſpired. It might perhaps be no difficult matter to ſhew, how a leſſer degree of this miſchief may produce effects, though ſeemingly very different from theſe now mentioned, yet in reality of the ſame pernicious nature: I mean, how ſuch an alteration of the common air, as renders it in a manner *mephitical*, (which is done by too much heat, and at the ſame time too great a proportion of watery and other groſſer particles mixt with it) may be the cauſe of epidemic diſeaſes, and, it may be, more eſpecially of thoſe, which, by reaſon of their untoward ſymptoms, are uſually called malignant.

FOR it is very remarkable, that *Hippocrates* (*s*) obſerved the conſtitution of the air, which preceded peſtilential fevers, to be great heats, attended with much rain and ſouthern winds: and *Galen* (*t*) takes notice, that no other than a moiſt and hot temperament of the air brings the plague it ſelf; and that the duration of this conſtitution is the meaſure of the violence of the peſtilence. *Lucretius* (*u*) is of the ſame mind: for in his admirable deſcription of the plague of *Athens*, "Theſe diſeaſes (ſays he) "either come from the air, or a-"riſe from the earth,"

------- Ubi putrorem humida nacta eſt
Intempeſtivis pluviiſque et ſolibus icta.

(*s*) Epidem. lib. ii. et iii.

(*t*) De temperament. l. i. c. 4. et Commentar. in epidem. l. iii.

(*u*) Lib. vi. ℣ 1099.

IN ſhort, the general hiſtories of epidemic diſtempers almoſt conſtantly confirm thus much; and would have done it more, if the vain notion of occult venoms had not prepoſſeſſed the minds of authors, and made them regardleſs of the manifeſt cauſes.

AND this is notorious enough in thoſe countries, where malignant diſeaſes are moſt rife: thus it is a very common obſervation in the *Eaſt-Indies*, that during the dry heats the ſeaſon is healthful, but when the rains fall immediately upon the hot weather, then untoward fevers begin to threaten.

THE ſame is obſerved in *Africa*: for (as *Joan. Leo (x)* relates) if ſhowers

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(*x*) Hiſtor. Afric. l. i. c. 1. Vid. Purchas's Pilgrims, b. vi. ch. 1. Dapper, DeſcriptioAfric. pag. 127.

ſhowers fall there during the ſultry heats of *July* and *Auguſt*, the plague and peſtilential fevers enſue thereupon, with which whoſoever is infected hardly eſcapes.

WHOEVER reflects on what has been ſaid of the uſe of reſpiration, and conſiders the propoſitions of *Bellini*, will eaſily underſtand the reaſon of theſe events.

THIS great demonſtrator has proved, that malignant and peſtilential fevers are owing to a viſcid and tenacious *lentor* or ſlime, which firſt obſtructs the capillary arteries, and afterwards, being diſſolved by heat, ferments with the blood, and changes it to a maſs unequally fluid and glutinous.

Now it is plain, that air, together hot and moiſt, not having force ſufficient to comminute the arterial fluid in the lungs, this, when it arrives at the ſecretory organs, will, inſtead of deriving into them their proper liquors, leave its moſt viſcid parts ſticking about their orifices, which by degrees make obſtructions. Theſe can only be removed by the *impetus* of the ſucceeding blood, and the agitation of heat: and then this ſlimy *mucus*, being again taken into the circulation, will, in the nature of a ferment, diſturb the whole maſs, and alter its natural properties.

I VERY well know, that the authority of *Hippocrates* is brought to ſupport the fancy of a latent aerial poiſon in ſome of theſe diſtempers: his Θεῖόν τι (*ſomething divine* (y) is conſtrued in this ſenſe.

(*y*) Vid. Prognoſtic. et Galen. Comment.

But his beſt interpreter, *Galen*, underſtood by this expreſſion no ſuch thing as they mean: on the contrary, he ſays it is a manifeſt conſtitution of the air, prevailing unſeaſonably, ſuch as himſelf has deſcribed in his Aphoriſms (*z*); and which is the ſame with that, of which we are diſcourſing.

MINADOUS (*a*) therefore rightly remarks, that, in his whole *epidemics*, *Hippocrates* never once mentions any venom as the cauſe of malignant diſeaſes; and, as to any thing really *divine*, the wiſe old man in other treatiſes (*b*) expreſly teaches, "That no diſeaſe comes "from the gods, one more than "another, each acknowledging

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(*z*) Sect. iii. Aph. 11.

(*a*) De febre malign. lib. i. c. 8.

(*b*) De aere, aquis et locis. et De morbo ſacro.

" its own natural and manifeſt " cauſe."

BUT it is foreign to our purpoſe to enlarge on this ſubject. I ſhall only hint, that phyſicians ought therefore to be very cautious in giving, as they often do, in caſes of this nature, under the notion of *Alexipharmacs*, ſuch medicines as raiſe a great heat both in the ſtomach and blood. Having engaged the *animal ſpirits* in war with *malignities*, they too often ſend treacherous auxiliaries to the ſuppoſed weak party; and, by exciting new tumults and diſorders, check and interrupt the work of nature, which always endeavours to conquer its enemy by *critical* diſcharges.

IT muſt indeed be owned, that ſome malignant fevers are contagious,

gious, and that contagion is a real poiſon: but the original cauſe of a diſeaſe, and the communication of it, are very different things. Of this I have largely diſcourſed on another occaſion (*c*): I ſhall therefore only hint here, that when a fever is communicated by way of infection from one already diſeaſed, this moſt commonly happens at the latter part of the diſtemper; that is, (as was obſerved in the *hydrophobia*) when the fermenting blood is throwing off great quantities of its active particles upon the glands of the moſt conſtant and eaſy ſecretions: ſuch are thoſe in the ſurface of the body and the mouth. Theſe therefore being by the air drawn into the lungs of a ſound perſon, and likewiſe inſinuating themſelves into the

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(*c*) Diſcourſe on the Plague.

pores of the ſkin, will affect firſt the nervous fluid, and then the blood, and produce the like fermentation and diſorder, which had been bred in the body from which they aroſe.

THE way, by which bad food, ill ripened fruits of the earth, *etc.* do often produce malignant and peſtilential diſeaſes, is not very different from that, by which we have obſerved unwholeſome airs to be the cauſe of the like effects. For the juices, with which thoſe ſupply the blood, being corrupted, muſt neceſſarily make a fluid neither fit for nutrition nor the animal ſecretions: and it is therefore no wonder, if, beſides the other ſymptoms enſuing, ſore puſtules, inflammations, ulcers, *etc.* (more common in fevers from this cauſe than in any other) are raiſed in the ſurface of the body.

IT is upon this account, that a *famine* is very often ſucceeded by a *peſtilence*. And this calamity generally begins among the poorer ſort of people, whoſe diet to be ſure is the worſt.

IT is a conſtant obſervation in countries ſubject to the plague, as *Turky* and *Africa*, that when the common inhabitants die in great numbers, foreigners who live in plenty, if they avoid communication with the infected, eſcape the danger.

THUS much concerning poiſonous exhalations and airs, ſo far as the conſideration of the *grotta de' cani* has led us on to inquire into to their effects. For though there may be other alterations of this ſame element, differing in their nature from this we have inſiſted upon, and yet equally pernicious and hurtful ; yet we take no notice of any of them, in regard that thoſe, which are from arſenical, mercurial, and the like fumes, are reducible to a foregoing Eſſay: and thoſe, which are owing to a change of the known properties of the air, may be eaſily explained, by what has been already delivered in this. I ſhall therefore rather chuſe to make ſome remarks on the miſchief of another fluid, which as it is the next in uſe to this we have been treating of, ſo the bad qualities of it, when it comes to be altered, muſt neceſſarily be almoſt equally fatal and dangerous.

I MEAN water, which is of ſo conſtant ſervice, not only for our drinks, but alſo in preparing of our fleſh and bread, that it may juſtly be ſaid to be the vehicle of all our nouriſhment: ſo that whenever this happens to have other properties than are neceſſary to fit it for this purpoſe, it is no wonder if in its paſſage through the body theſe make ſuitable impreſſions there.

THUS at *Paris*, where a part of the city is ſupplied with a water from *Arcueil*, which is ſo full of ſtony particles, that even the pipes, through which it runs, are in time incruſted and choked up; Dr. *Liſter* has obſerved, that the inhabitants are more ſubject to the ſtone in the bladder, than in moſt other places *(d)*.

IN like manner, let the groſs particles, with which the water is ſaturated, be of any other nature, *metallic*, *ſaline etc.* theſe, according to their various gravity, the capacity of canals, and ſuch like circumſtances, will, when they come to circulate in the animal body, be by the laws of motion depoſited in one part or other. So thoſe mineral bodies, and nitrous ſalts, which abound in the ſnowy waters of the *Alps*, do ſo certainly ſtuff and inlarge the glands of the throat in thoſe who drink them, that ſcarce any who live there are exempted from this inconvenience (*e*).

(*d*) Vid. Liſter's Journey to Paris.

(*e*) *Quis tumidum guttur miratur in Alpibus?* Juvenal. Satyr. xiii.

FOR this reaſon, the choice of water for drink among the ancients was by weight, the lighteſt being preferred, as moſt free from all heterogeneous bodies.

THE caſe therefore of poiſonous ſprings is, their having corroſive corpuſcles mixt with their water, which cannot fail, when forſaken of their vehicle in the canals of the body, to do the ſame miſchief as they would, if taken by themſelves undiluted: only with this difference, that they may in this form be carried ſometimes farther into the animal oeconomy, and ſo, having paſſed the *primae viae*, diſcover their malignity in ſome of the inmoſt receſſes. Thus the *fons ruber* in *Aethiopia*, (*f*) men-

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(*f*) Lib, xxxi. cap. 2.

tioned by *Pliny* (*f*), about which abundance of native *minium* or *cinnabar* was found, ſhewed its ill effects chiefly on the brain: and therefore *Ovid* (*g*) ſays of it,

> *------- Si quis faucibus hauſit,*
> *Aut furit, aut patitur mirum gravitate ſoporem.*

We ſhall not need then to enlarge on this matter; ſince any of the forementioned mineral poiſons may thus impart their deadly quality to waters: and accordingly there are inſtances of *arſenical*, *mercurial* *etc.* fountains, of which the hiſtories may be ſeen in the collections of the learned *Baccius* (*h*); and one very remarkable in the *Philoſophical Tranſactions* (*i*).

(*g*) Metamorph. lib. xv. v. 320.
(*h*) De Therm. lib. vi.
(*i*) Number 8.

BUT as we before took notice concerning *airs*, ſo it may be worth the while to obſerve of *waters*; that there are ſome alterations of them, which though not properly poiſonous, yet are of ſo great conſequence in their effects, that they may very well deſerve to be regarded.

THIS I ſhall do with reſpect to a great abuſe, committed in this kind about the city; and that is, in chuſing ſometimes ſtagnating impure well-water for the brewing of beer, and making other drinks. Such a fluid indeed has oftentimes a greater force and aptneſs to extract the tincture out of malt, than is to be had in the more innocent and ſoft liquor of rivers: but for this very reaſon it ought not, unleſs upon mere neceſſity, to be made uſe of; this quality being owing to the mineral particles and aluminous ſalts, with which it is impregnated.

A LATE author (*k*), by ſearching into the firſt accounts of the diſtemper we call the *Scurvy*, deſcribed by *Pliny* (*l*) and *Strabo* (*m*), under the promiſcuous names of *ſtomacace* and *ſcelotyrbe*; and examining the authentic hiſtories of it in later years, made by the moſt obſerving phyſicians in thoſe countries, where it was unhappily revived, as *Olaus Magnus*, *Balduinus Ronſeus*, *J. Wierus*, *Solomon Albertus*, *etc.* finds that the origin of it was in all times and places charged upon the uſe of unwholeſome ſtagnating

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(*k*) Dr. J. H. Scelera aquarum: Or, a Supplement to Mr. Graunt on the bills of mortality.

(*l*) Lib. xxv. c. 3.

(*m*) Geogr. lib. vi.

nating waters. Then by comparing together the claiey *ſtrata* of the earth about the cities of *London*, *Paris*, and *Amſterdam*, he ſhews, that where the water is worſt, there this malady is moſt rife. So that he has put it out of all doubt, that moſt of the perplexed and complicated ſymptoms, which are ranged under this one general name, are in a great degree owing to the ill qualities of this element.

AND indeed *Hippocrates* himſelf, as he has very plainly deciphered this diſeaſe (*n*), by the title of σπλῆνες μέγαλοι, or *great ſpleens*; ſo he does very particularly in another treatiſe (*o*) take notice, that drinking of *ſtagnating well-waters*

(*n*) Prorrhet. lib. ii. c. 16.
(*o*) De aere, aquis, et locis, ſub finem.

muſt neceſſarily induce an ill diſpoſition both of the *ſpleen* and *belly*.

IF we inquire into the reaſon of ſuch ill effects, we muſt conſider, that *clay* is a *mineral glebe*, and that the groſs particles and metallic ſalts, with which waters paſſing through ſuch a bottom abound, are, as Dr. *Liſter* (*p*) obſerves, not to be maſtered, that is, indigeſtible in the human body. Not only therefore will theſe cauſe, as he very well argues, calculous concretions in the kidneys, bladder, and joints, and as *Hippocrates* experienced, hard ſwellings in the *ſpleen*; but they muſt neceſſarily oftentimes by their corroſive quality twitch and irritate the

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(*p*) De fontib. med. Angl. p. 2. pag. 75. At foſſilia ſive metallica ſalia alia atque alia ſunt, et nobis et pene igni dixeram indomabilia.

ſenſil membranes of the ſtomach and bowels, and thus hinder and interrupt the digeſtion of our food. Nay, beſides all this, when they come into the blood, it is no wonder, if the ſmall canals of inſenſible perſpiration are frequently ſtopt and obſtructed by them: for it is upon this ſcore that *Sanctorius* (*q*) teaches us, "that
"heavy water converts the mat-
"ter of tranſpiration into an *ichor*,
"which being retained, induces a
"*cachexy*."

WHAT miſchiefs will enſue hereupon every one ſees; not only pains in the limbs, livid ſpots in the ſurface of the body, ulcers, *etc.* from the acrimony of the undiſcharged moiſture; but many beſides of thoſe nervous com-

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(*q*) Medic. Static. § ii. Aphor. 6.

plaints, which go by the name of *hyſterical* and *hypochondriacal*, may take their riſe from the ſame ſource: for the before cited *Sanctorius* (*r*) has remarked, that the *flatus* or *wind*, ſo inſeparable from thoſe caſes, is no other than "the "fluid of perſpiration rude and "unfiniſhed."

IF theſe inconveniences are oftentimes not felt, at leaſt not till towards the declining age, in ſtrong and active habits of body; yet I am, from very good experience, aſſured, that they deſerve conſideration in weaker conſtitutions, and a ſedentary life, eſpecially of the more tender ſex.

(*r*) Ibid. § 3. Aph. 13. Flatus nil aliud eſt quam rude perſpirabile.

FOR theſe reaſons *Pliny* (*s*) tells us, "that thoſe waters are "condemned in the firſt place, "which, when boiled, incruſtate "the ſides of the veſſels." And that our well-waters do this, no body, who ~~looks into the~~ common tea-kettles, can be ignorant.

AND indeed in ancient times, as that part of medicine, which relates to diet, was more carefully ſtudied, than it is now; ſo this point particularly, of which we are treating, was of ſo great moment, that *Hippocrates*, who wrote the beſt book (*t*) on the ſubject that ever was publiſhed, has in a

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(*s*) Lib. xxxi. c. 3. Damnantur imprimis fontes, quorum aquae decoctae craſſis obducunt vaſa cruſtis.

(*t*) De aere, aquis, et locis.

great meaſure accounted not only for the diſeaſes, but even for the temper and diſpoſition of the people of ſeveral countries, from the difference of their airs and waters.

G. V.^{ar} Gucht Sculp.

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Tab:III.

Fig. 4.

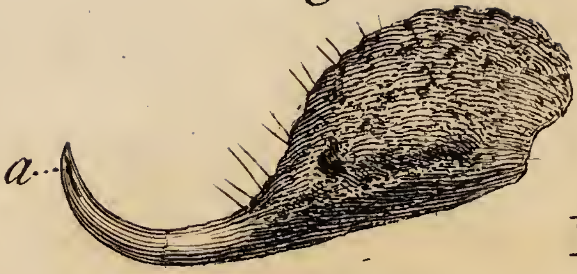


Fig. 1.

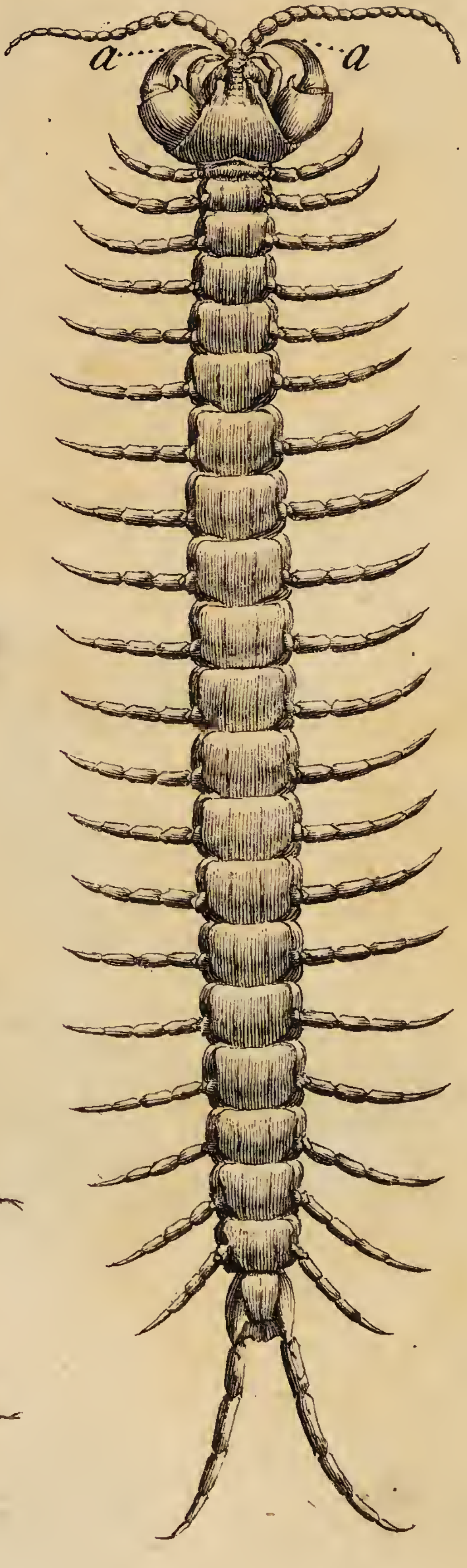


Fig. 3.

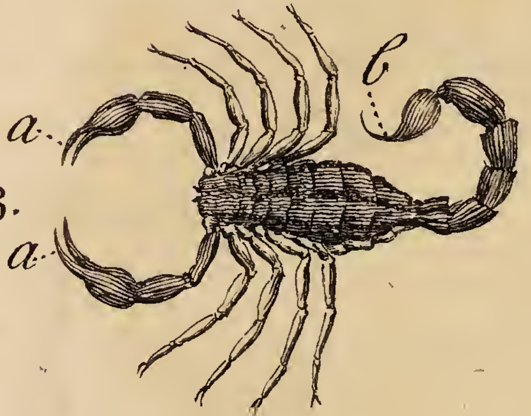
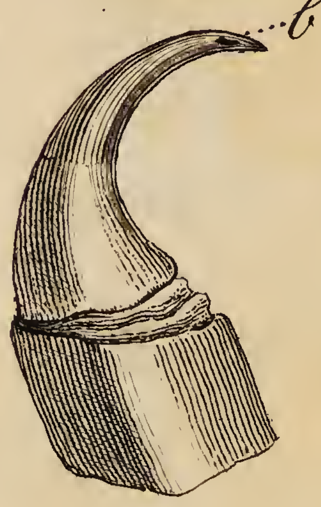


Fig. 2.



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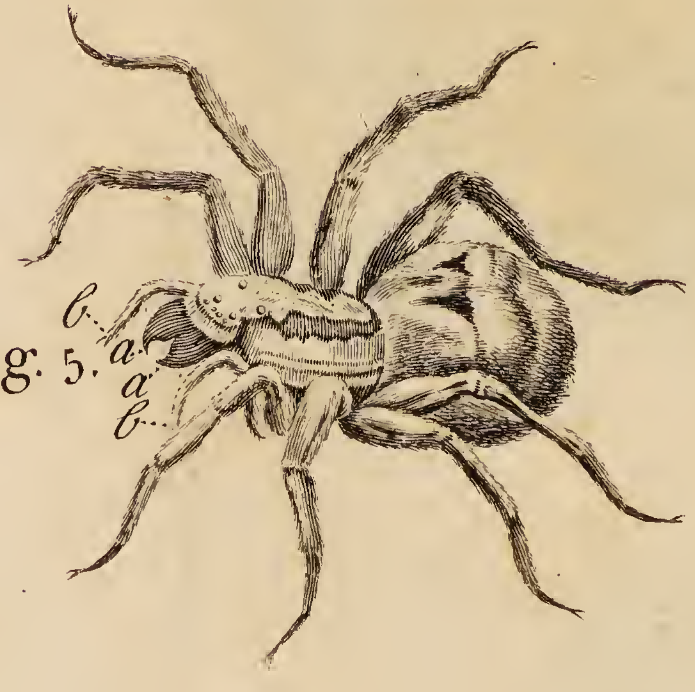

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Fig.1.

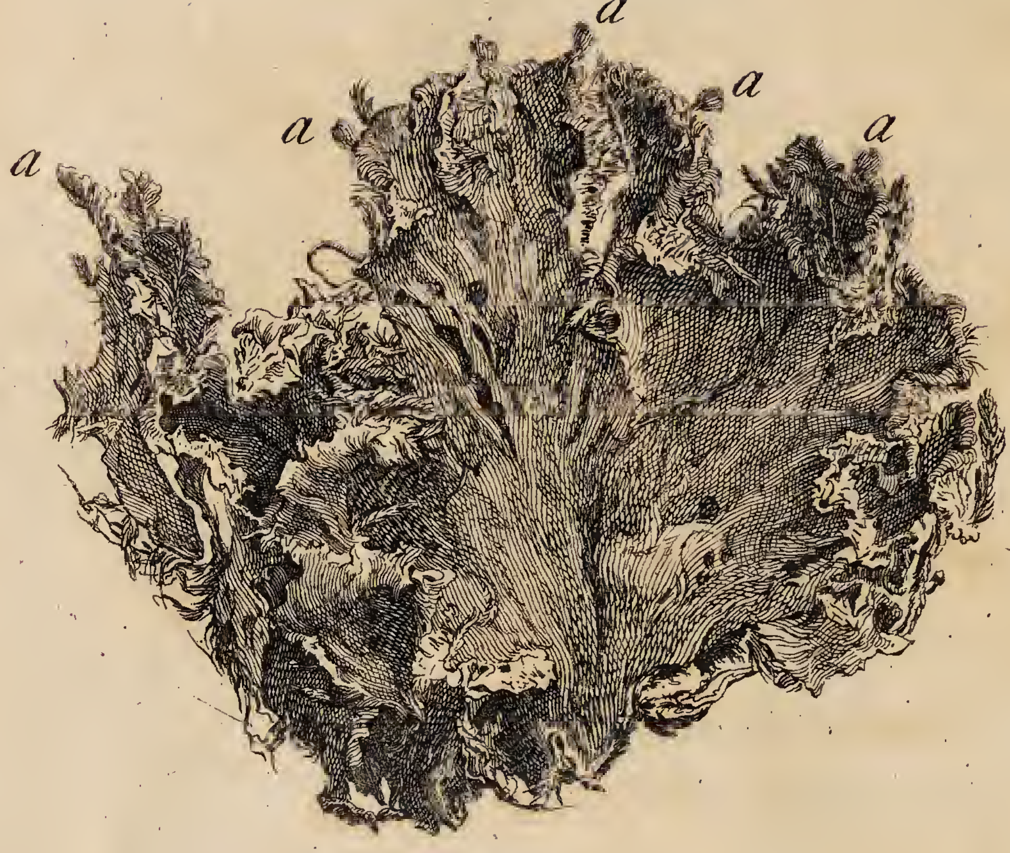


Fig.2.

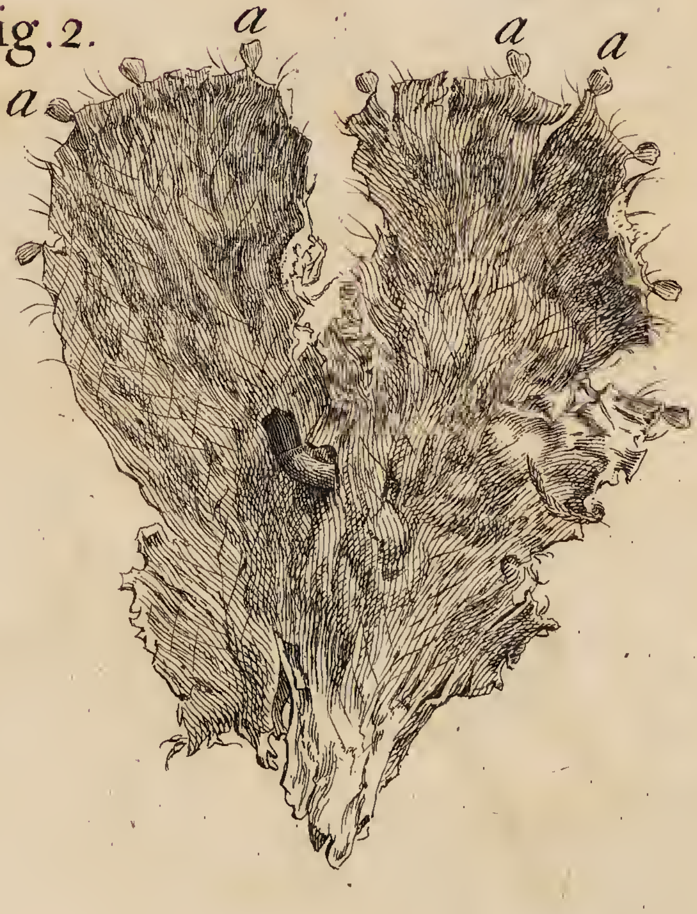
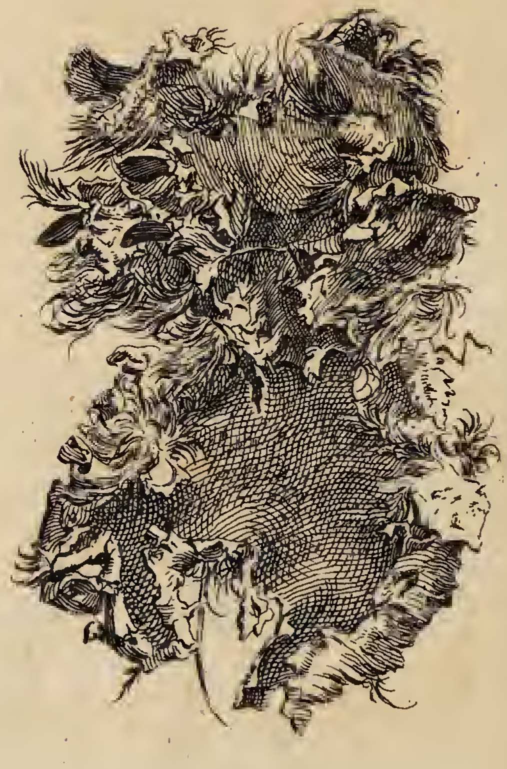


Fig.3.



The explication of thoſe Figures, which are not explained in the Treatiſe.

TABLE III. The *Scolopendra.*

FIG. 1. *a a.* The claws of the poiſoning *forceps.*

FIG. 2. One of the claws magnified, in which appears the aperture *b.*

FIG. 3. The Scorpion.

a a. The claws.

b. The tail with the ſting at the end.

FIG. 4. The ſting magnified, to ſhew one of the ſlits, out of which iſſues the poiſon *a.*

FIG. 5. The *Tarantula.*

a a. The wounding *forceps.*

b b. The feelers.

TABLE IV.

FIG. 1. The upper part of an expanded leaf of the *Lichen.*

a a. The *Peltae* or ſeminal *Capſulae*, at the extremities of the leaves.

FIG. 2. The under ſide of the ſame leaf, with the *Peltae*.

FIG. 3. A view of a leaf, as it lies on the ground unexpanded.

FINIS.

ERRATA.

PAge 146, line 10, *for* noitce, *read* notice; p. 158, l. 16, *for* of, *r.* or; p. 164, l. 10, *for* de, *r.* be; p. 166, l. 9, *for* trible, *r.* tribe; p. 181, l. 12, *for* ſymytom, *r.* ſymptom.

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